THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

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CLOSED FOR THE HOLIDAYS.

WHEN summer has really happened, and the weather makes high noon at breakfast time, the smallness of the post bag brings some relief, marred a little, perhaps, by violently-tinted postcards of the impossibly pleasant places where most of the staff is concealing its address; every season is reflected in the mail, advertisements of a thousand and one devices to help one to enjoy or withstand the particular brand of weather which the almanac indicates as being due, notices of stocktaking, and appealing little slips on the overdue account which really must have escaped your notice.

But the particular characteristic of the August letter is a tendency to break out into a little red rash informing the recipient that the sender's establishment will be closed for a more or less lengthy period for the annual holidays.

This growing tendency to overcome the difficulties of the staff holiday list, by making a short clean sweep of it, is not without interest, although often causing inconvenience to the clients of the "resting" enterprise.

From the point of view of a directorate, there is possibly much to be said for a system which leaves the full staff available for 49 weeks out of the year and closes the works during the slackest period, but the older method of extending the holidays over several months was evolved slowly with the growth of the modern yearly holiday from home system, and has much to recommend it to both employer and employed.

It means that so far as the customer is concerned, the works are never closed or reduced in output capacity, judicious arrangement will secure that men who are mutually dependent are seldom away together, and an excellent opportunity is afforded of bringing forward the assistants and generally preventing different departments and classes of work from falling too completely into the hands of any individual. The arrangement of holiday relief is a reminder to the management of the need for competent under-studies to every official of importance, and renders it easier to deal with absence through illness or other emergencies. However trustworthy and competent a departmental superintendent may have become, it can only be advantageous to himself and his chiefs for him to realise that at regular intervals he must hand over his "dossier" to another; a strong incentive to "clearing up" and proper record keeping is obtained.

Possibly, in the case of works producing materials and specialities which are sold from accumulated stock, some of the objections to entirely closing down do not apply, but in engineering works a large proportion of the orders are executed specially for customers, and so long as the holiday closing is not universal, few manufacturers are in a sufficiently independent position to be certain that their clients will wait for them in time of emergency, even if it were wise to cause the inconvenience of so doing to established customers—always the most valuable class of business connection.

Apart from these considerations, the week or fortnight's cessation from work must be reflected in the total turnover. At present, public holidays account for at least one week in 52; two more would decrease the working hours of the year by nearly 4 per cent., or £4,000 on an annual turnover of £100,000. Taking 10 per cent. of this as available for distribution as profit, £400 would be obtained—a sum which might be applied to some system of holiday bonus to those members of the staff who are obliged to accomplish whatever work falls to them in the year, irrespective of recognised hours of duty or holidays; some recognition of the extra work thrown on each by the holidays of all would remove a grievance, tend to keep work from getting into arrears and minimise the inconvenience of the holiday season, removing to a great extent the objection that to many persons in responsible positions a holiday entails the clearing-up of a mass of accumulated work upon their return.

The social aspect of this question is also, perhaps, worthy of attention. Any general system of closing large businesses in August must increase the congestion which is already so apparent at pleasure resorts and on the trains and boats which serve them, the railway and the hotel managers would find their summer peak increased and narrowed, which could only result in the cost and incidental discomfort of summer holidays becoming greater also, whilst the immense temporary increase which takes place each summer in the population of certain resorts already presents problems of some difficulty to the local authorities.

Generally there appears to be much in favour of spreading out the vacations over the few months which in this country still enjoy some reputation for fine weather; this method, at least by the laws of chance, should offer a man the probability of a higher average of fine weather over a term of years than would be likely if he invariably went away in the same month.

A Question for Electrical Contractors.

Our attention has been directed to an agreement which has been entered into by a leading firm of conduit and electrical supplies manufacturers and the Electrical Contractors' Association in regard to the conditions under which the principle of direct trading between the said manufacturer and the general public is approved. We have not received a copy of the complete agreement, save in the columns of the *Electrical Contractor*, though it is true that an abstract in which the wording is not always identical and with the omission of two clauses, one of them of considerable importance, appears in the publicity organ of the manufacturer who is party to the agreement—*Installation News*, just to hand.

Almost as long as we can remember electrically has the question of direct trading on the part of some of our electrical manufacturers and factors given rise to considerable ill-feeling and no little actual friction.

It was this question perhaps more than any other that led to the formation of the Electrical Contractors' Associations which desired to get level with the firms who sometimes deprived the contractor of profit by going out competitively and offering the actual user lower terms than the contracting middleman could possibly quote. Our readers are already acquainted with the fact that at the "Electric Home" in the grounds at the White City an effort—as worthy as we understand it is proving successful—is being made by the firm alluded to, to popularise the domestic applications of electricity with the general public; one feature of this undertaking is an understanding between the firm and the Contractors' Association that on all sales effected at the Exhibition by the former, it shall pay 5 per cent. to the latter organisation. This, by some, would be described as a sop to the electrical contractor for giving official approval to the principle of direct trading. Of course, the firm could have done as it pleased at the White City without consulting the contractors or their Association, but by entering into the agreement the Association recognised that there was nothing extraordinary, or little more than already obtained, in the elimination of the middleman under certain circumstances. But the principle involved is now further acknowledged and approved in the present agreement. There is, however, in the complete copy a clause of some significance and great potentiality which does not appear in the *Installation News*. This clause says that "nothing in this agreement shall prevent the Association from entering into a similar agreement with any other manufacturing firm or company," so that the Contractors' Association has not bound itself or the individual contractor hand-and-foot to buy from the firm alluded to in order to secure his share of trade discounts when his customers go direct to the firm with or without his card. Really, as far as we can see, there is nothing to prevent the Association from entering into similar agreements with all the other manufacturers of conduits, or any electrical supplies, although by Clause VI the Association has agreed, in consideration of the firm's undertaking, to urge its members to "purchase their requirements from the company, and to give the company's goods preference in case of equal value and equal prices." Nor are we clear that any advantage given by the firm is to be confined to contractors who are members of the Association; in the absence of specific statements to the contrary, we infer that the offer is open to contractors all and sundry, though, no doubt, primarily intended for members of the organisation.

In Clause II it is provided that if the user or his agent calls as a direct purchaser without the contractor's recommendation or introduction, and has goods charged to his own account, then, if the company "know of or can trace the customer's electrical contractor, they shall pay him one-half the difference between the list and trade price." This is interesting if at first blush it appears somewhat idealistic. It is followed in Clause III by a provision that "in cases where the user or his agent has no electrical contractor, or where the company are unable to trace same, then the company shall pay into the central fund of the Contractors' Association an amount equal to one-half the difference between list and trade prices." We suspect that the Association Central Board will have little need to appeal to its local branches in future for small loans, as it has recently been doing, for we cannot imagine any busy manufacturing firm going out anxiously on the hunt for possible claimants to its conscientious generosity. We can imagine cases, however, where more than one contractor would claim to be the contractor for a particular customer who had succeeded in arranging a direct deal with the manufacturer. The company are to render to the Association statements and cheques quarterly, and "if necessary" such statements will be certified by the auditor of the company.

We do not wish it to be gathered that we are querulously inclined toward efforts that are made in the direction of harmonious co-operation between manufacturers and the contractors, but we make the foregoing observations in the conviction that the question is not one to be handled precipitately. The agreement is only for one year in the first instance, and when that period has elapsed we shall be able to tell whether it works to the full satisfaction of both parties. There were differences of opinion among contractors at its birth! If it is not renewed, however, the fact will remain that the contractors of this country as an organised body have given their august and authoritative approval to the principle of direct dealing between manufacturers and users, under certain circumstances. Therein may lie important possibilities of which the contractors may not then speak quite so highly. We have no doubt that other manufacturers will watch the experiment with more than ordinary interest, for the subject of arranging special terms between the manufacturers generally and the members of the Contractors' Association, has already

been fully considered by the members of the National Electrical Manufacturers' Association and a number of outside manufacturers, as we recorded in our issue of July 9th (page 64). The meeting was an open one, and it endorsed the decision of the Manufacturers' Association, that the terms put forward by the Contractors in April, involving, *inter alia*, preferential dealing with the members of their Association, could not be entertained. In this connection a contemporary last week stated that it had been *found impossible* to arrange an agreement with the Contractors' Association. This is stretching the words circulated by the secretary of the Manufacturers' Association to make them mean something that they were never intended to convey. There are some things which cannot be entertained, not because they are impossible, but because the general consensus of opinion is that they are *undesirable*.

That was the feeling in the case alluded to, and if one company has succeeded in agreeing with the Contractors on the lines indicated above, it merely means that they have done so because many firms, when they had deliberated carefully upon the matter, declined to enter into what they regarded from various points of view as an undesirable arrangement.

Brussels Exhibition.

We have received a *brochure* from Mr. H. Greville Montgomery, M.P., which forms an excellent corollary to the remarks on the Brussels Exhibition in our last issue. Mr. Montgomery writes with exceptional qualifications: as secretary to the late Baroness Burdett-Coutts, by his long connection with a trade journal, and by his great experience as the promoter and organiser of successful Trade Exhibitions,* he has accumulated such a mass of knowledge of all sorts and conditions of men that he has had no difficulty in reaching that goal of so many ambitions—the British House of Commons.

The opinions of such a man are entitled to respect, and it is with satisfaction that we note his agreement with the views expressed in these columns as to the advantages that would accrue from the formation of a body of manufacturers and other commercial men similar to the Associations of Exhibitors formed on the Continent. "Before this country is committed to any great International Exhibition," he writes, "the commercial aspect of the venture should be submitted to a Representative Committee of Manufacturers, appointed by an association of not less than 2,000 members, so as to cover every industry in the United Kingdom." Needless to say how cordially we agree with Mr. Montgomery; and we would go further, and suggest that no better promoter of such a scheme could be found than Mr. Montgomery himself, who would know how and to what extent to apply that *legitimate* pressure on manufacturers (and, we would suggest, others interested in trade and commerce), whereby alone the success of the venture would be possible. As a preliminary we would recommend the study of the *Historique du Comité Français des Expositions à l'Etranger*, given in the *Bulletin* of the Association; the special knowledge thus acquired would be found invaluable, and would enable the promoter to materialise what may be called the motive power of all such undertakings, or to use a homely phrase, "The horse that draws the cart."

This leads us to a part of the *brochure* in which we find it impossible to follow the author, viz., in his criticism on what he calls "putting the cart before the horse," and making arrangements for participating in an exhibition before consulting such an Association. Now, as this "horse" is not yet in being, some other motive power had to be found for propelling the "cart." According to an American report which the author quotes, in the United States "Special letters were written to individual firms, urging them for patriotic and commercial reasons to exhibit. Much was also done by the directors at the heads of the various groups, who travelled about energetically using their personal influence to induce producers to exhibit, and the Commissioner-General himself, who visited nearly all the principal centres of industry, where he addressed meetings and generally stimulated interest in the exhibition." This, says the author, is what was done in the United States, and he goes on to say "we believe that a similar course is being adopted to induce British manufacturers to go to Brussels next year." We may add that all the Chambers of Commerce of the kingdom have been approached with the same object; this he calls "unfair pressure," for firms "of their own free will would rather not exhibit," "undue influence is habitually brought to bear upon them to conquer that reluctance." Is not this placing the British manufacturer in rather a sorry light? And what form should *legitimate* influence and pressure take?

Lastly, Mr. Montgomery, without justification, falls foul of the *personnel* of the new exhibition branch. No more experienced man than the gentleman in charge of the Art Exhibition at Rome could possibly have been found, and if Mr. Montgomery would only read and inwardly digest the report of the Royal Commission as thoroughly as the secretary had of necessity to do, he would rise from the task with the conviction that he had acquired a thoroughly liberal education in the subject which, if accompanied by youth, energy and enthusiasm would make him an ideal organiser; and this we take the present Commissioner-General to be—for besides possessing the above qualifications, he has proved himself to be willing to take upon himself responsibility to an almost "sporting" extent and far removed from ordinary red-tapeism. On the cover the title of the *brochure* is "Great International Exhibitions. Are they of Commercial Value to British Manufacturers?" The only persons that can give an authoritative answer to this are those to whom the question relates, and such answers are to be found in great variety in the report of the Royal Commission—but not in the pamphlet. The title inside is: "Should Great Britain take part in Them? Manufacturers' Interests v. Government Policy." In some cases political considerations are of paramount interest; but even in these rare cases it is not correct to assert that this policy is antagonistic to traders' interests; what is good for the country as a whole must necessarily be of some benefit to anyone having a stake in it. No panacea for the various ills enumerated by Mr. Montgomery is given in his pamphlet, nor any hint as to how it can be ascertained beforehand what benefits are likely to accrue to manufacturers from exhibiting, or whether they can count upon any commercial returns from Brussels whatever, except the formation of the Association mentioned above; the sooner this is done the more will the new department be relieved of some of its most irksome duties, and the better it will be able to devote its energies to the other and very onerous tasks imposed upon it.

* ". . . . upon individual manufacturing firms . . . . the great burden falls (whilst the profits too often go elsewhere)."

Tramway Competition.

One is so accustomed to a half-yearly wail at the South-Eastern and Chatham Railway meetings in regard to the depredations of the wicked tramways in South London, that there is usually little incentive to probe deeply into the respective chairmen's remarks. For of all the companies which cater for the suburban traffic of the Metropolis in competition with the tramways, these close friends alone have tacitly agreed that discretion is the better part of valour, and retired ingloriously from the fray.

If we look for reasons—and the allied chairmen are perfectly frank about it—we find that any move on their part would have to be a drastic one, and would result in the tramways throwing "all their energies into meeting any effort which might thus be made"; also that enormous expense would be involved in electrification, if that were adopted. And so these good friends modestly leave the arena of their peaceful, if slumbrous, activities.

One would have liked to let the matter rest here, but some further remarks by the Chatham chairman seem to demand attention. This gentleman (Sir W. Hart Dyke)

having glanced (casually, we suppose, to be in keeping with S.E. & C. traditions) at the last L.C.C. tramways report, discovered that the receipts per car-mile averaged 11·81d., and "that ¾d. per mile was estimated as ample for all renewals." He proceeded to remind his hearers that the average figure in the case of railways for renewals of permanent way and rolling stock was at least 1s. per mile, and with these most misleading figures to urge the impossibility of competition.

The facts, of course, are that the ¾d. represents the Council's contribution to its renewals fund—a fund established partly on account of the uncertainty as to the life of the tramways material—which is in addition to the annual expenditure on repairs to electric lines, charged to revenue, and amounting last year to over £140,000.

We do not admit that a real comparison is possible between two widely different concerns such as these, but in order to show where Sir William's 1s. per mile comes in and to emphasise the fact that it has nothing in common with the L.C.C. renewals fund, the following figures may be of interest.

The Council on its electrical routes earned 11¾d. per car-mile; operating expenses amounted to 6·8d., including 1·4d. expended on repairs and maintenance—the percentage of operating expenses to revenue being 57. Now the South-Eastern and Chatham joint lines earned, during the last half-year, 66¾d. per train-mile; operating expenses figured at 39½d., and included, roughly, 14d. per train-mile expended on maintenance, repairs, &c., of track, locomotives and rolling stock, the percentage of working expenses to revenue being 68.

Now this is not a bad showing for a railway which is admittedly wanting in many respects from the passenger's point of view, and one may, therefore, be pardoned for taking a rather more sanguine view than the chairman as to what might happen if the London routes were electrified.

Copper. Messrs. Merton's monthly return, now to hand, chronicles further considerable increase in the visible supplies. These have now reached 76,559 tons, a figure which would have seemed impossible in 1907, when the highest return did not amount to 20,000 tons. Of the total, 62,573 tons are stocks in London, Birmingham and British ports. The analysed returns present no marked departure from the average, but it is noticeable that during the last four months the supplies from North America to Europe have increased considerably.

The Power of Concentration. We are sometimes tempted to suspect that among those in responsible executive positions the power of concentrating their attention upon the various matters submitted to them is becoming almost a lost art.

The managers of large business undertakings are constantly having brought to their notice mistakes which have arisen owing to the careless manner in which subordinates have read their instructions. Let a customer, for instance, who has hitherto taken delivery at his own premises, order a machine to be sent direct to some other destination. Quite an appreciable percentage of instructions such as this are overlooked, the goods being sent to the usual address. Apparently the order is read through hurriedly, and the note as to destination entirely passed over. Many other examples could be given of failure to thoroughly grasp the contents of an order or letter, the results often causing delays and annoyance.

Fortunately modern inspection methods go a long way towards checking mistakes of this nature, and the use of printed forms has a further beneficial effect.

At the same time, the habit of glancing through written or printed matter without thoroughly understanding the meaning is an exceedingly bad one to get into, and unless it can be overcome, the memory is certain to suffer.

The power of concentration is often under-mined amongst heads of departments by the constant demands for their attention to all kinds of petty difficulties amongst their assistants. We cannot help thinking that in many cases such a state of things implies lack of competency on the part of the officials in question. If the department be properly organised and work carried on in the most effective manner, the head of it should not be troubled by a constant flow of small difficulties, his attention being mainly taken up with important matters which he should have ample time to go into thoroughly.

In organising a new or chaotic department, minor troubles will be continually in evidence, but for this state of things to continue is strong evidence against the methods adopted.

The Collection. Years ago, when engineering undertakings were smaller and almost exclusively in private hands, periods of service were of much longer duration than is now the case, and office staffs might be looked upon as more or less happy families. Under these conditions retirements, or removals to other firms, were important events, and they were invariably celebrated by a presentation to the departing official from his less fortunate *confrères*. When you have come closely in contact with a man daily for many years, it is generally a pleasure to contribute towards a testimonial to commemorate his departure. You may have quarrelled with him most of the time, but these differences will be forgotten, or looked back upon with leniency, under such circumstances. Weddings were also marked in a similar manner, and as these events only took place at long intervals, everyone could afford to give liberally according to the position he occupied.

The size of modern undertakings, together with the large staffs employed and the frequent changes now customary, have entailed the making of collections for the purposes above mentioned at very frequent intervals; furthermore, the individuals to be benefited are often personally unknown to some of the contributors.

One may be willing to help the victim of misfortune without having come in contact with him, but there is no rhyme or reason in giving a leaving or wedding present to someone you have barely spoken to. The "essence" of a present is pleasure or eagerness on the part of the giver, and if this feature be absent, the reasons for giving are not by any means flattering to the recipient.

It is no uncommon occurrence for a junior assistant, getting, perhaps, 30s. a week, to be asked to contribute towards a leaving present for a man he has never spoken to, with five or six times the salary, and who is substantially bettering himself by making the change.

Then, again, these frequent collections are a serious expense to members of a large staff. We have in mind a large electrical undertaking having works in the country and a London head office, an extensive contracting business being attached to the latter. In this case the staff at the works were always asked to contribute towards wedding and leaving presents for officials even in the London contracting department, their names being sometimes unknown to many of the contributors.

Few people like to refuse when asked to give towards such objects, whilst the unfortunate heads of departments and managers are left no choice in the matter, blank spaces being provided at the heads of the lists for their names and amounts after the remainder of the staff have been filled in. This final stage is very simple; the departmental heads give double the amount contributed by the next name below them, and the manager has to double again.

This public present giving in large commercial undertakings is becoming out of date, the relationship between the members of the staff under modern conditions being more of a short business acquaintance than a long family connection; and in view of the tendency of salaries to decrease, the custom should be limited in scope or put a stop to entirely.

MESSRS. ARCHIBALD SMITH & STEVENS'S ELECTRIC LIFTS.

We recently paid a long-promised visit to the "Janus Works," Queen's Road, Battersea, where, for many years, Messrs. Archibald Smith & Stevens have been engaged in the manufacture of lifts and hoists, mainly of the electrically operated type. The accompanying illustration, fig. 1, is a view of the main bay in the fitting shop, where the winding engines and controllers are assembled and tested, showing several machines in various stages of completion; besides the mechanical shops, which are well equipped with machine tools for the manufacture of winding gear, controllers, switchgear, &c., there is a large department devoted to the cabinet work involved in the manufacture of the cages and other woodwork. The whole of the firm's machines are entirely British made, and they claim that they were the first to produce an all-British electric lift. In this connection it is interesting to note that Messrs. Smith & Stevens have developed a large export trade, in addition to the steady demand for their machines in the United Kingdom.

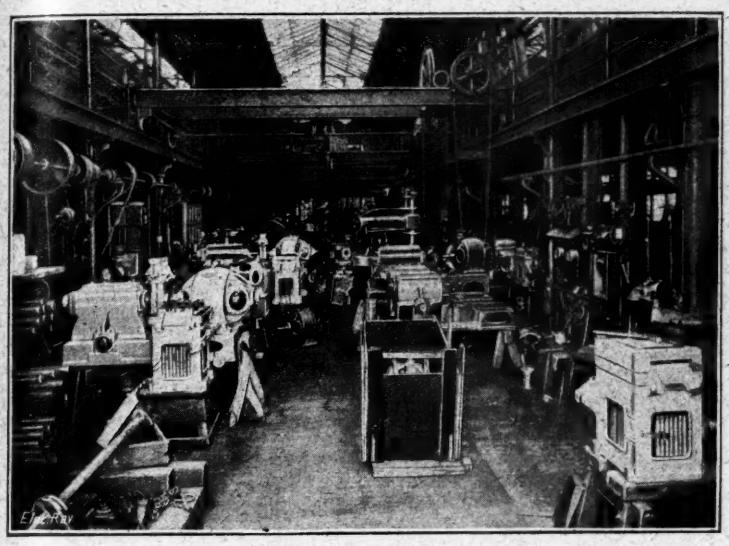

Fig. 1.—Main Shop, Janus Works.

While the firm are willing to supply winding gear driven by a continuously-running countershaft, where the necessity for keeping down the initial cost to the lowest possible figure is the paramount consideration, they regard this system as distinctly inferior to the direct-coupled system, in which a reversing motor is used, driving the winding engine directly and running only when the lift is running; in the latter case the consumption of energy is strictly proportional to the traffic, whereas in the former, in view of the large proportion of time during which the cage is at rest, the waste of energy involved in driving the shafting continuously may far exceed the amount of energy usefully employed. The special feature of their work, therefore, is the direct-driven winding engine, and this is adopted in conjunction with either mechanical or electrical control, the latter again being automatic or hand-operated as desired. The full automatic push-button lift in particular has been carried to a high degree of efficiency by the firm.

The winding engine in all these modifications consists in the main of essentially the same parts, namely, the motor and worm-gear, brake and controller. In the earlier designs the firm combined all these parts on a single bed-plate; experience, however, pointed out the desirability of separating the controller from the other parts, with the result that the design illustrated in fig. 2 has been developed. Here we see the motor on the left, with the magnetic brake between it and the worm-gear case, and the controller at any convenient distance, actuated by a sprocket wheel and chain from the main winding shaft. The motor is supplied of any desired pattern, open or enclosed, and is shunt-wound, with a few series starting turns. The magnetic brake, which is actuated by a single long-pull solenoid in series with the armature, is provided with strong springs and wooden brake-blocks acting on the periphery of the motor coupling; the brake is of the balanced type, exerting no side pressure upon the shaft, and stands clear of the brake-drum when the shaft is running.

The worm runs on the top of the worm-wheel, the lower part of which runs in an oil bath, thus ensuring the ample lubrication which is indispensable to the efficient working of such gear; the working surfaces of the gear and of the main journals are made exceptionally large, to reduce the unit pressure below that at which the oil would be squeezed out, with the result that wear, it is claimed, is entirely obviated. The gearing is machine cut, and is so designed that it cannot be driven backwards by the load under any conditions, the brake being employed merely to ensure a quick stop. The main shaft carries a rope-wheel with vee-grooves, round which the suspension ropes pass from the cage to the balance weight; the makers strongly recommend this system in preference to the winding-drum type, claiming for it lessened wear and tear on the ropes, and greater safety against over-winding, for if either the cage or the balance-weight reaches the end of its travel, the ropes are no longer gripped in the grooves, and their motion ceases. The "slack rope" trouble is also eliminated, and there is a saving in the amount of rope required.

The controller may be operated by means of a hand rope passing through the cage; fig. 3 shows one of this type, with the rope-wheel at the right. The rope-wheel is geared to a shaft carrying a compound cam, cast in one piece, which actuates levers coupled to the horizontal contact bars seen at the top of the figure. These bars carry contact blocks bearing on contact studs, by which the various connections for running in either direction and for cutting out the starting resistance are made. The resistance wires are enclosed in a cast-iron frame, and are of ample proportions to withstand the effects of rapidly recurring starts without heating to an injurious degree. The resistance bar, it will be noticed, is actuated by a double chain attached to a drum, in such a way that no matter which direction the drum may move in, the bar is always pulled outwards. The chain drum is driven through a friction clutch by a chain and sprocket wheel, geared to the winding engine, so that the latter by its own motion cuts out the starting resistance; thus it is impossible to cut out the resistance unless the motor has actually started, and the speed of cutting-out is proportional to

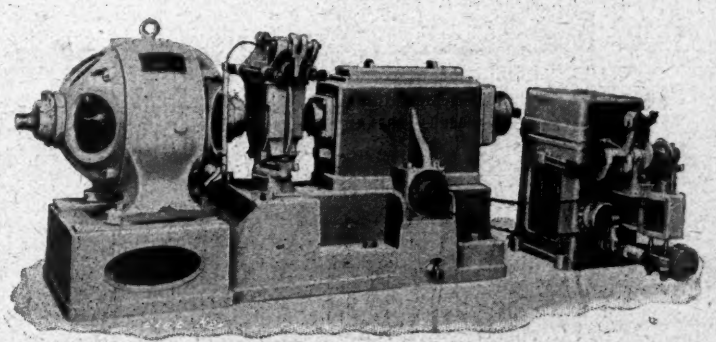

Fig. 2.—Complete Winding Engine and Controller.

the speed of the motor. Whenever the cage is stopped, the whole of the resistance is at once automatically replaced in circuit. When a short journey is completed, the direction-controlling bar is not replaced unless it is desired to reverse the motion, and as the whole of the circuits are automatically interrupted before these bars can be moved, the reversing contacts never break a current.

Fig. 4 shows the electrically-operated controller, which is actuated by two solenoids of special design, acting on a cam-shaft to control the reversing bars; the cam shaft also controls the friction clutch which brings into action the

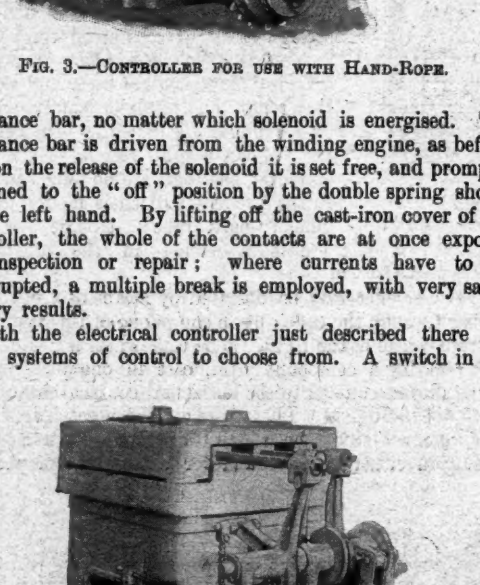

Fig. 3.—Controller for use with Hand-Rope.

resistance bar, no matter which solenoid is energised. The resistance bar is driven from the winding engine, as before, and on the release of the solenoid it is set free, and promptly returned to the "off" position by the double spring shown on the left hand. By lifting off the cast-iron cover of the controller, the whole of the contacts are at once exposed for inspection or repair; where currents have to be interrupted, a multiple break is employed, with very satisfactory results.

With the electrical controller just described there are three systems of control to choose from. A switch in the

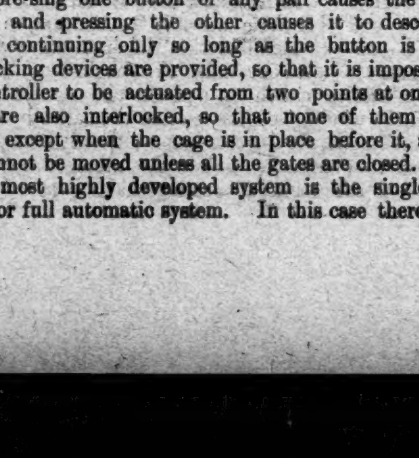

Fig. 4.—Electrically-Operated Controller.

cage is the simplest form, and needs no description. Again, two push buttons can be fixed on each floor, and two in the cage; pressing one button of any pair causes the cage to ascend, and pressing the other causes it to descend, the motion continuing only so long as the button is pressed. Interlocking devices are provided, so that it is impossible for the controller to be actuated from two points at once; the gates are also interlocked, so that none of them can be opened except when the cage is in place before it, and the cage cannot be moved unless all the gates are closed.

The most highly developed system is the single push-button or full automatic system. In this case there is only one button at each floor; when any button is pressed for an instant, the cage is automatically brought to the corresponding floor, where it stops and unlocks the door, which cannot be opened until the cage arrives at the specified landing. The cage cannot move again until the door is closed and locked. Inside the cage are buttons corresponding to the different floors, which enable the passenger to convey himself to any desired landing. This is the usual equipment of push-button lifts, but in addition Messrs. Smith & Stevens provide a master button in the cage, with which the lift can be stopped at any point—as, for instance, when the wrong button has been pressed—and restarted by pressing the proper button. The system depends upon a system of relays controlling horizontal contact bars under the cage; a wiper is provided at a suitable position on each floor, and as the cage arrives in position, this wiper pushes back the bar which has been actuated, and stops the cage always in the correct position, quite independently, of course, of any stretching of the ropes, or of the load in the cage.

Safety in operation in all these cases is provided for by the use of four steel wire ropes in the case of passenger lifts, and a special safety gear which grips the guides the moment any of the ropes fails or stretches unduly. Other safety features have already been mentioned, and in particular we should refer to the new design of automatic gate lock which has been evolved by Messrs. Smith & Stevens in the course of their wide experience. We understand that, including their hydraulic and steam-operated lifts, they have some 7,000 machines in operation, some of them for many years, and have never had a single failure.

While the electric lift costs some 15 to 25 per cent. more than the hydraulic type, it is a recognised fact, based upon unimpeachable records, that the running cost of the former, as a rule, amounts to only from one-quarter to one-half of that of the latter. Alternating current can be employed as effectively as direct current, though with somewhat lower efficiency, and Messrs. Archibald Smith & Stevens have installed many lifts on single-phase and polyphase circuits.

THE AUTOMATIC TRANSFORMER SWITCH.

By "STUDENT."

Great attention is now being given by manufacturers and others to the design of a reliable automatic switch to save the "no-load" losses in small transformers.

It seems, however, that this is far from being a necessity, and the real use, and hence sale, of it *should* be quite small; that is, of course, from the consumer's point of view. Anything that sells does good to the seller, but it is doubtful whether it is always good for the community at large.

Those users of transformers—such as hotels, underground offices, tube railways, &c.—who have at least one or two lights on all day and night have no use for an auto-switch. Users of large transformers will not require a switch, because the no-load loss in these large sizes can fairly easily be reduced to about 0·75 per cent. of full load, which is very small in comparison with the total amount of energy expended, and the amount which would thus be saved would easily be outshone in 99 out of every 100 cases by exercising a little economy in the quantity of energy consumed. Also, where large transformers are used, they will either be always on load, or only put on for a short period at full load. The latter would be the case in such places as theatres, kinematograph shows, &c., when of course a switch would be used on the primary side of the transformer.

It will thus be seen that the only person who would benefit (?) by an auto-switch would be the user of the small transformer up to, say, 1 kw.

Now, the losses in this size, at the worst, are about 20 per cent. of the full-load current, that is, 10 watts on the 500-watt size, this being the size of the majority of transformers for house and small shop lighting.

Taking the average lighting hours as 4½ per day, this would give 19½ hours loss per day of 10 watts = 195 watt-hours. This is equal to 71 units per annum, which, at 4d. per unit, would cost 23s. approx. By spending more

money on the original cost of the transformer for a better quality of iron, this loss may be reduced by 40 per cent., *i.e.*, to about 14s.

The cost of the 500-watt transformer is something in the neighbourhood of £2, so that an extra 10s. or 15s. or so is not a great item to pay for the better iron and lower loss.

The cost of the auto-switches at present on the market is about £3 each. Therefore, by using a £3 switch, 14s. per annum can be saved on a bill amounting to £6 or £7 after 4¼ years, which time is wanted to pay for the switch. Four and a quarter years is a very long time when dealing with electrical matters, and it is doubtful whether there are many installations which, during the next 4¼ years, will not need altering in some way or another; this always affects the supply, *i.e.*, the transformer, and hence, if installed, the auto-switch. All these savings and calculations, however, are based on the assumption of perfect working of an automatic device, which, unfortunately, is rather a rarity in practice.

Contractors and others should be cautioned to exercise great care and circumspection before installing an automatic switch, for it must be remembered that it *can* go wrong, but it has the delightful property (to the maker) of not always betraying itself if it fails. Who can say whether a switch acts or not, so long as the light comes on? It may be stuck *in* for years, and so have losses going on all the time without anyone knowing anything of its misbehaviour. Perhaps what the eye does not see the electrician will not grieve over!

The metal-filament lamp is quite delicate enough, without adding to our present many chances of failure.

As has been shown, it is generally only the private householder or small shopkeeper who needs to save the "no-load," and in his case undoubtedly the best way to do so would be to put in two two-way switches, one in the hall and one upstairs, interconnected so that the transformer may be put on or off from either point. This would only cost a few shillings.

In conclusion, let us remember that we cannot afford to run risks, and that we must look before we leap.

"FOUNDATIONS."

We are all familiar with the care and attention which is rightly bestowed upon the superstructure of the edifice of our national defence, but few of us concern ourselves with its foundations.

Our Empire is founded upon the character and training of its citizens, and the efficiency of our fighting forces is dependent upon the nature of the training and education that obtains in the community.

As a nation we are tacit believers in our capacity to "muddle through" when a crisis comes along, and as a preliminary to this process the muddled and unsystematised state of our foundation layer does not seem to the majority of us to be in any way alarming, and to some may even appear to be appropriate.

It is not our purpose at the moment to deal with the costly foundations in our existing system of elementary education, but rather to briefly review the state of our secondary and higher educational systems which bears directly upon our industrial progress and success.

On inspecting these foundations we find, firstly, a number of large blocks or corner stones scattered irregularly about the site. These corner stones are the universities; some of them are old and some new, and most of them differ from one another as to the nature of the test-ring through which their constituent material has to pass before incorporation. We commend this matter to the consideration of the Engineering Standards Committee.

Grouped in an irregular manner around these corner stones, and in a few cases connected to them by a trace of cementing material, are a number of other blocks of varying dimensions. These are the technical and secondary schools, but of any ordered design in their relation to one another or to the corner stones there is but the faintest trace.

We find on inquiry that the Government architect, in the form of the "Board of Education," is responsible for this design.

The attention of the Board is largely taken up in inspecting, measuring up, and pricing according to schedule, the work done and attendances made by the students in the technical and secondary schools, and in the issuing of certificates and money grants based on elaborate and voluminous returns. So engrossed is the Board in the detail of this work that it has no time to pay attention to design; it therefore instructs the clerks of works and foremen (the "Directors of Education" for the counties and county boroughs) that they have a free hand to develop along their own lines and to meet local needs. This is an excellent notion in its way, but is hardly conducive to good general design.

The Directors of Education and secretaries of Education Committees restrict themselves almost entirely to their own territories. It is true that they have formed themselves into an association which sometimes holds meetings, and that they have even gone so far as to partition the country into provinces, with a vague notion of somehow or other co-ordinating the educational work in these districts; but of real effective work in this direction they have done nothing.

It is apparent that the division of the country into counties and county boroughs does not lend itself well to a proper co-ordination of the educational machinery. The real focus points should be the universities, and these are located quite independently of the county system.

It should, however, be possible to create around each university a "sphere of influence," the affairs of which would be guided by an advisory committee composed of members representative of the educational authorities concerned, together with a leaven of business and professional men of high standing and of teachers.

Such committees could do much to regulate and harmonise the educational activities of their districts, and, by preventing overlapping and by making more definite the aims of the institutions concerned, would increase their efficiency. They would act as a sort of Conservancy Board for our educational rivers and streams, and would supervise their channels from the source to the point where they discharge their contents into the great sea of our national life.

They would see to it that we had some sort of common standard for admission to the universities in the shape of a leaving-certificate from the secondary schools, and, within limits, that a student could transfer from one university to another without the heavy sacrifice in time and money that he is now frequently called upon to make.

It may be urged that some such system is already in existence, as the universities frequently appoint representatives on the education committees and on the boards of management of the chief schools of their districts; but it must be admitted that their action on these bodies is rather that of isolated units, and that as the result of their labours the desired co-ordination has not been achieved.

BELGIAN ELECTRICAL INVESTMENTS ABROAD.

During the concluding years of the nineteenth century an enormous amount of French and Belgian capital was invested in, among other industries, iron and steel works in Russia, but since that time an entire change has been brought about by the transfer of the attention of the former two countries to participation in electrical enterprises of various kinds, both in Europe and on other continents, particularly on the part of the Belgians. The primary reason for the alteration of policy is to be found in the circumstance that investments in Russian metallurgical works have resulted in considerable losses of capital, and have assisted in developing the undertakings from the point of view of capacity of production considerably beyond the actual needs of the country, either at that or the present time. On the other hand, the assumption of an interest in electrical schemes afforded a fresh opportunity for the employment of capital in directions likely to be of eventual financial advantage. The outward flow of Belgian and French capital to iron and steel and other industrial establishments has practically ceased for several years past, except in cases where it has been deemed advisable to provide additional money in connection with

projects of reconstruction or reorganisation, in the hope of still being able to prevent the absolutely total loss of the original investments; but no diminution has occurred in the availability of funds for foreign electrical undertakings down to the present moment.

The Société Générale Belge d'Entreprises Electriques, which is one of the Belgian investment companies of the kind concerned, enumerates in its report for 1908 25 different undertakings in which it is financially interested to the total amount of £429,000. Of these only four are situated in Belgium, and three are lighting companies and one a manufacturing works. With one exception, all the remainder are located in France, Russia, Italy, Spain, Austria, Denmark, Turkey and South America, the latter country being represented by the Compagnie Générale de Tramways de Buenos Aires, which is absorbing the whole of the tramways in this Argentine city. The largest individual participation of the Belgian company refers to the Buenos Aires tramways, and amounts to £128,000; the second position is indicated by an interest of £53,000 in the Lyons Omnibus and Tramway Co., and these are followed by £30,000 invested each in the Adamello General Electric Co., and the Bilbao Tramways and Electricity Co. The annual report makes brief reference to each of the undertakings, showing the development which is proceeding in each instance. The dividend declared at the recent meeting was at the rate of £1 10s. per ordinary share, being the same as was distributed for 1907.

The Société Générale de Chemins de Fer Economiques, whose combined share and loan capital amounts to £1,280,000, is apparently the owner of the Brussels tramways, which represent the sole instance of the company's investments in Belgium. Among the other participations may be mentioned various towns in Italy, which country is particularly favoured by the company; Spain, France and Austria, together with the Cairo tramways and the Société de Chemins de Fer de la Basse Egypte et Tramways de Port Said, the Damas tramways and lighting undertaking in Turkey, and the Buenos Aires tramways. Several of the investments apply to identical companies in which the Société Générale Belge d'Entreprises Electriques is interested, and this circumstance either points to the probability of co-operation between the two companies, or to the entertaining of similar expectations in regard to the prospects of the undertakings concerned. The net profits realised in 1908 reached £89,000, and a dividend has been declared at the rate of 12 per cent. on the ordinary capital of £640,000.

The Société Financière de Transports et Entreprises Industrielles represents a third Belgian investment company which commands a share capital of £600,000, and an obligation loan of £200,000, whilst its holdings in undertakings are entered at £760,000. In this case also, and apart from the shares held in the Charleroi and Borinage electricity supply works and in the manufacturing firm of the A.E.G.—Union Electrique, most of the external investments are in the identical enterprises in which the two preceding companies are interested in various European countries. The company likewise has a participation in the Compagnie Générale de Tramways de Buenos Aires, but unlike the other two Belgian investment companies, it has also an interest in the German Transmarine Electricity Co., of Berlin, whose developments in the course of the past two or three years have conferred upon it a practical monopoly of light and power supply at Buenos Aires, quite irrespective of what has been accomplished by it at Santiago, Valparaiso and Monte Video. The net profits of the Société Financière in 1908 were £61,000, and a dividend at the rate of 7½ per cent., or £1 10s. per share, has been declared on the ordinary shares, as contrasted with 7 per cent., or £1 8s. per share, in the preceding year.

The Compagnie Internationale d'Orient of 48 Rue Namur, Brussels, which has an ordinary share capital of £400,000, is a general investment company mostly in connection with undertakings in the Far East. Among these are to be found the names of two banks, the Chinese Engineering and Mining Co., and two other mining enterprises, and several railways in China. Obligations and shares are held in the Electric Traction Co., of Hong Kong, the Singapore Electric Tramways, Ltd., and the Compagnie Générale des Tramways de Buenos Aires; whilst shares only are represented by participations in the Compagnie Française de Tramways et d'Eclairage Electriques de Shanghai (the French concession), the Shanghai Electric Construction Co. (the international concession at Shanghai), and the Compagnie de Tramways et d'Eclairage de Tientsin. The company is also interested in obligations in the Tramways de Mexico, the Société Générale d'Entreprises au Canada and the Sumatra Caoutchouc Co. The accounts show a net surplus of £21,000 for 1908, which has allowed of the payment of a dividend of 5 per cent. on the share capital.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, of 75, Boulevard Haussmann, Paris, is representative of French investment companies. It has a share capital of £2,000,000, and is very largely interested in the Paris Metropolitan Railway, the Société d'Electricité de Paris, and the Jeumont manufacturing works known as the Ateliers de Constructions Electriques du Nord et de l'Est. The Société d'Electricité, has large works at Saint Denis, and the kilowatt-hours of consumption which in 1907-8 amounted to 33,864,000, are expected to exceed 54,000,000 KW.-hours in 1908-9. The Société Parisienne also has investments in the Belgian Gas and Electricity Co. of the Hainaut, in Belgian and French tramways, the Tramways en Russie, the Cairo Electric Railways and Heliopolis Oases Co., and in other undertakings. The net profits amounted to £132,000 in 1908, and these have permitted of the distribution of 6 per cent. on the share capital.

The principal feature of the Belgian and French investment companies, of which only a few have been referred to, is that the interests assured in other enterprises are, generally speaking, not of a temporary character, but are representative of what may be termed permanent holdings in so far as the duration of the concessions owned by the individual undertakings is concerned. The circumstance is probably partly explained by the fact that some of the tramways or lighting works are initiated either in Belgium or France, or indicate the joint endeavours of promoters in both countries. But no general policy of buying shares or bonds for a rise, in order to sell at a profit, appears to be pursued, although such a method may be practised in isolated instances for comparatively small parcels of securities.

ARTESIAN WELLS.

By W. H. BOOTH.

In London the action of the Water Board recently drew attention to the question of independent water supplies. For very large quantities it would not be desirable to attempt to secure water by means of an artesian well, though there are some few wells in London which yield something like 15,000 gallons per hour.

But any place may count upon obtaining a sufficiency of water for boiler feeding purposes. Even a large generating station, if it has water for condensing purposes unfit for boiler feed, may obtain its make-up feed from a well.

London is by no means an area of copious supply. The surface stratum next below the merely superficial gravels is the London clay. This, of course, is waterless. There are other sandy and clayey beds between the London clay and the chalk from which deep wells are supposed to draw their supply; supposed, because it is probable that much of the supply really comes from the Thanet sand which overlies the chalk. The chalk surface is undulating, and, therefore, its depth below surface varies with the locality, and the yield of water is also very variable. There is one well defined area of so-called dry chalk which extends from about Deptford, westwards to Newbury in Berkshire; the writer has proved the comparative dryness of this band of chalk at numerous points between and at those extremes.

Though the London clay and the chalk beneath it are practically horizontal, this dry band does very much represent the edge of the so-called London basin, in so far as to the south of the band the water is much more copious and stands at a higher level and to the north it is also more copious, but partakes, as to level, of the general character of the London area over which there is a slow depression in progress, the water-level becoming lower every year. South of the dry band the water-level was till recently maintained, in parts, nearly 20 ft. above the surface. This seems to show that the dry band of chalk is a band of compression, past or through which water cannot travel from the southern outcrop in a northerly direction. Hence the overflowing of water from wells pierced on the south side of the dry band, one of which, well known to the writer, has been flowing since the year 1834. This well probably draws from the Thanet sand.

It is a peculiarity of chalk wells when bored through the overlying strata, that they yield water very much less hard than that from boreholes put down into chalk which is bare—that is, boreholes put down upon the surface outcrop of the chalk. The softness is attributed to the Thanet sand effect.

Taking England generally, the dip of the various rocks is so great that the whole surface of the country is divided into a frequent succession of dry and of water-bearing beds. There are, therefore, very good prospects at all places of some supply without boring to extraordinary depths.

There are few spots indeed where the ordinary factory cannot obtain a supply, though there are places, of course, where the artesian engineer would hesitate to advise even the attempt to bore.

Artesian borings divide themselves into two main classes: (*a*) those bored directly into the water-bearing stratum upon its surface outcrop and (*b*) those bored through the stratum, at the surface, into the water-bearing rock below. An example of the first would be a well bored on, say, the downs where the chalk is at the surface, while all the London chalk wells are examples of the second class. This second class cannot usually be depended upon to give the same free and copious yield as can the first class, because the supply to the second class must of necessity travel down to the stratum either through the strata above or, when these are impervious, through the water-bearing stratum itself from its surface outcrop. As in the case of London wells, the outcrop may be miles distant, and the supply is limited by the resistance of the stratum to horizontal penetration.

Speaking generally, water does not travel through the rocks by penetration of the actual substance of the rock. Chalk, for example, is by no means a freely pervious rock. The water travels by way of fissures or along the veins of nodular flints. Clay will not fissure permanently, and is, therefore, practically waterless. Fissures are produced in rocks by earth movements, and are formed in clay strata equally with rock strata, but in clay they automatically close owing to the plasticity of the material. In a hard rock they do not close so completely, and form a ready passage for water.

It is the work of the expert to estimate the probabilities of a supply in any locality. One hears a good deal of the diviner's art,

but it appears to be chiefly guess work, for the expert artesian engineer will diagnose a dozen cases with greater accuracy than the diviner. In contemplating the putting-down of a well, one must consider what is the stratum to be tapped? How far is it below the surface? What is the superficial area of the rain-receiving outcrop which feeds the rock? What is the level at which the stratum is drained? For this determines the water level in the bore hole. This is very important, since it might happen that the proposed stratum at the intended site would be pierced through before the water horizon had been reached. In such a case the next lower stratum which was water-bearing might have to be tapped.

On the water level much depends. If the water rises near the surface, it may be drawn by a surface pump, or it may be lifted out of the bore by an air-lift pump. But if the water level is far down, the air-lift pump demands a lot of power to work it, and also a bore hole very much deeper than the water level. A low level well will often require to be pumped by an inserted low level single-barrel pump, but a well to hold a pump must be much larger than if it has only to contain air-lift tubes. Thus each case must stand on its own merits. It is very desirable that the above matters should be estimated with fair accuracy beforehand, because any error in estimating the water-level may completely change the subsequent plans as regards pumps.

Bored wells should be lined with stout iron or steel butt-jointed and socketed tubes. In a London well, these tubes will extend from the surface to a point 15 or 20 ft. in the chalk. It is in fixing them in to the chalk that well borers often exhibit carelessness and ruin the work by allowing the sand above the chalk to creep through to the bore-hole.

In some rocks of a loose nature, the hole may require lining through the water-bearing horizon. In that case, the pipes must be perforated to admit the water. The writer has bored wells which gathered their supply from three separate rocky strata, divided from each other by strata of clay. Such cases require particular and careful treatment, so as to secure the maximum results; and it is very important that minute records of the stuff passed through should be kept by the foreman and submitted to the engineer, in order that the lining shall be designed for the best results.

PROCEEDINGS OF INSTITUTIONS.

Electricity Applied to the Reduction of Waste.

By A. B. Gridley.

(*Abstract of paper read before the* Cleveland and Durham Engineering Society.)

During the last 10 or 15 years, the electrical engineer has almost entirely changed the leading industries on Tyneside, and great progress has been made on Teesside, although a public supply of electricity on a comprehensive scale was not seriously attempted there until 1907; several private plants have been superseded, and no fewer than seven central supply stations have been shut down, except for emergency use. The two main principles governing centralisation are decreased capital outlay per kilowatt, and the effect of the diversity factor. The big supplier has the advantage not only in the purchase of plant, but also in the reduction of coal, stores, labour and repairs, while the power user benefits by a reliable and cheap supply through duplicate mains from several interconnected generating stations. Although the supply of power to a colliery would seem difficult to justify, no fewer than 45 collieries in the district are being, or about to be, supplied from the public mains.

Experience on the North-East Coast shows that works whose installations aggregate 120,000 kw. can be supplied with 40,000 kw. of plant; if these works had their own generating plant, about 106,000 kw. would have to be installed, costing £3,180,000, whereas the supply authority's capital outlay would be only £1,060,000. There is still in the district some 200,000 h.p. not yet electrically operated, and, calculating on the same basis for the supply of this, there would be a capital saving of the order of £2,750,000.

In addition to the saving of labour due to the concentration of the generating plant in large units, there is a saving in labour in the works supplied; one man can look after 1,000 h.p. of motors of various sizes, and there is a saving due to the absence of coal and ash handling, &c. Mr. C. H. Merz has pointed out that if all the colliery owners in the district purchased their coal from an outside source, 1,750,000 tons of coal per annum, worth say £500,000, would be set free for sale; and Mr. Beilby states that if the power used in all our factories and mines were supplied from central stations, the coal used—sixty million tons a year at present—could be reduced by one-half, representing an annual saving of over £11,000,000, and materially prolonging the life of the British coalfields. The local Power Supply Co. having complained of the excessive charges for carriage of coal, the railway company showed that the demand for coal from the works supplied by the company had fallen off to a trifling amount, while the coal consumed by the company was far less than the previous aggregate consumption of the works supplied. There is also a substantial saving in water, which is of great importance to local authorities and their ratepayers.

The use of electric power reduces waste of time, owing to the rapid acceleration obtained with electric motors, which is typically illustrated in the electrification of railways; this further results in increased mileage from a given amount of rolling stock, a better service, and a greater volume of traffic.

The removal of boilers, engines, buildings, &c., from works on their conversion to electric driving sets free a large amount of space, which is frequently of great value; the electric motors substituted take up very little room, and can be mounted on walls or overhead, without occupying floor space at all. Messrs. Musgrave, of Bolton, now take 1½ million units a year from the Corporation supply, and have reclaimed ¾ acre of land formerly occupied by generating plant.

The waste of energy in shafting, which in many mills amounts to from 30 to 70 per cent. of the whole consumption, is greatly reduced by the adoption of electric motors.

By the reduction in capital outlay, the assessments for rates and taxes may also be reduced, and savings are possible in boiler, fire, accident and workmen's insurances—facts which are often ignored when a manufacturer is comparing his own costs with an offer from an outside source, as these charges are usually allocated to general establishment charges by accountants.

The amount of waste in the form of exhaust steam, waste heat or combustible gas in the Teesside district is very great; it has not hitherto been utilised, owing to the absence of a market for the continuous supply of energy necessary to its economical employment. It is only by co-operation that the ideal of a 100 per cent. load factor becomes feasible; and this has now been accomplished. A network of mains stretches from Blyth, in Northumberland, to Loftus-in-Cleveland, through the Northumberland coalfield and

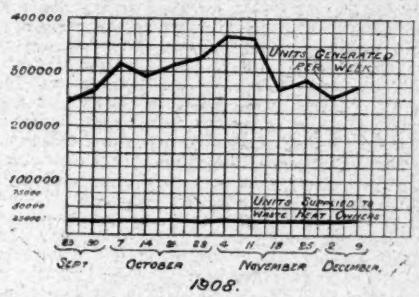

Fig. 1.

Tyneside, across the Tyne in two places, through the East Durham Coalfield, to the Iron Mines District, with numerous branches, loops and connections with important centres. Eight power stations are in operation, and three others are under construction. The main regulating coal-fired stations are at Carville and Grangetown; the waste-heat stations at Blaydon, Weardale, Newport, Bankfoot and Tees Bridge, are, or will be, run at their full capacity day and night. There is now no difficulty in disposing of as much energy as can be generated from waste heat in the district, and the owner of the waste heat receives energy for his own use at the lowest rates, while a reliable stand-by is secured by the linking-up of each waste-heat station to the transmission system. While the erection of a number of small waste-heat stations appears to be in contradiction to the policy of centralisation, it should be remembered that each of these stations is run constantly at full load, so that there is a very large number of units generated over which to spread the increased capital and operating charges, and at the same time the distance of transmission to the point of use is reduced. Although figures cannot be given, in no case has a proposal on co-operative lines been submitted to a waste-heat owner that has not ultimately been accepted by him. The accompanying diagram, fig. 1, shows the result of the system at the works of the

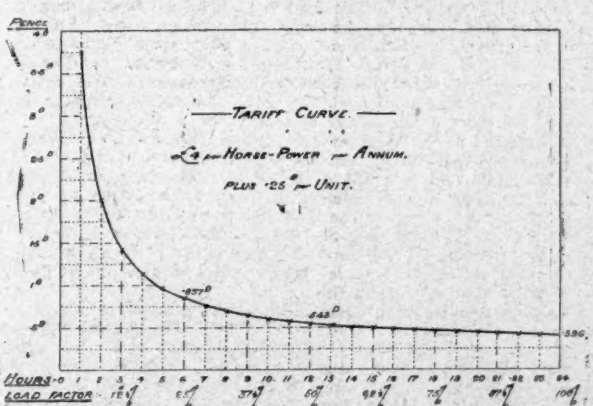

Fig. 2.

Weardale Steel, Coal and Coke Co., Ltd., the space between the upper and lower lines showing the energy sold to outside consumers.

In addition to actual economies, benefits are derived from the increased output due to the adoption of electric driving, with its higher speed and even turning moment; extensions of manufacturing plant are also facilitated, at small outlay. Perhaps the most

important point of all is the general supply of power at prices comparable with those charged in water-power localities, attracting new industries to the district, with the accompanying increased employment and prosperity.

In discussing the price of electrical energy, both producers and consumers have drifted into the bad habit of reducing their calculations to cost per unit. This, by itself, conveys no information of material importance; it must be accompanied by a definite statement as to load factor, total annual consumption, &c. It is this fact which is leading all suppliers of electricity for power purposes who really appreciate the economics of electricity supply to avoid the quotation of flat rates, as they may be unfair to both parties. A charge which is framed to cover, first, the capital and fixed costs, and secondly, the running or variable costs of giving the supply, is sound. Capital cost is of paramount importance. The varying conditions are met by a tariff based on a fixed charge per kilowatt or B.H.P. demanded—which demand is not "peak," but an average taken over half-hourly periods—plus a running charge per unit consumed, as, for example, £1 per quarter per B.H.P. demanded, plus ·3 or ·25d. per unit. Such a tariff is embodied in fig. 2, which shows the average price per unit at different load factors.

The Development of the Large Gas Engine.*

THOUGH Mr. Bechtel's recent paper on the above subject was largely based on his particular knowledge of the Nurnberg gas engine, it may usefully be read as showing the general status of large gas engines. In order to give an idea of the extent to which these are now employed, the author gives a table of engines of 1,000 B.H.P. and upwards. The total is about 1,030,000 B.H.P. Nearly 850,000 of this is driven by blast-furnace gas, and 68,000 by coke-oven gas. Producer gas drives 36,000; town gas nearly 25,000; and natural gas—all in the United States—nearly 50,000. Driving dynamos, there are over 515,000 B.H.P.; blowing engines aggregate 404,000 B.H.P.; rolling mills nearly 17,000; other purposes about 54,000 B.H.P. Electricity, therefore, has benefited to the extent of one-half the total power developed, as Thwaite anticipated. Turning now to the countries where the large gas engine has been chiefly developed, we find that Germany leads with nearly 482,000 B.H.P.; the United States, though late in the field, stands for 337,000 B.H.P; Belgium possesses about 51,000 B.H.P.; Great Britain, 24,986; France, about 55,000; Austria a little over 25,000; other countries aggregate some 65,000. There is no reason why Great Britain should lag behind Germany, almost her equal in iron production, for all the blast furnaces in Great Britain are close to great industrial centres requiring power. Moreover, the use of blast-furnace gas was first shown to be possible by an Englishman, and the gas was first used in a gas engine in Scotland. The only reason must surely be sought in the supineness of those who might have benefited by what Germany has gained so much in carrying out.

Mr. Merz is, we believe, on record as having endeavoured to show that with a gas-engine plant there must be also a steam plant as a stand-by. Mr. Bechtel points out in answer to this that on the Continent there are numerous works entirely denuded of steam plant. There is a steamless plant, for example, at Hayingen, where, when furnaces are started up, the blowing plant is driven by electric motors from a plant several miles distant. Another steamless plant is that at George-Marienhütte, at Osnabrück. The works there are all electrically-driven, the motive power being entirely gas; while at the Haspe works in Westphalia, producers have been erected to supplement an insufficient gas supply from the furnaces. Thus, there is no reason at all to maintain steam plant, and such statements are unfair, and show want of inquiry into facts.

Then much is heard of the heavy upkeep of gas engines. At 11 iron and steel works the annual costs of repairs and repair wages are only 1 to 2 per cent. of the first cost of the gas plant itself. The 2 per cent. rate refers only to older plants. The following costs of repairs per kilowatt-hour are given with plant load factors of various degrees:—

Load factor.	Cost per KW.-hour in pence.
57 per cent.	0·01000
66·5 "	0·00875
62·5 "	0·01220
33·0 "	0·01300
66·0 "	0·00640

The average is 0·00851d. per unit. Thus, if so much as 2 per cent. be allowed for repairs and 7 per cent. for depreciation and 4 per cent. for interest, the total charge for a 1,000-B.H.P. plant will be 24s. per B.H.P.-year and about 19s. for a plant of 2,000 B.H.P.

About 1 gramme of oil per B.H.P. per hour will run the engine, dynamo and auxiliaries. This amounts to 2,111 gallons per year, at 1s. 6d. to 1s. 9d. per gallon.

A 2,000-H.P. gas blowing plant ran during 19 months 13,639·5 hours, and stood for 230·5 hours. The plant wages were £662; materials, oil, waste, &c., cost £665, and repairs £133; the total cost of running was £1,460, or 0·0128d. per B.H.P.-hour. The stoppages were only such as were required for tap-hole repairs to the furnaces.

The cost of attendance is to be determined by taking one unskilled labourer as oiler for each tandem engine, and for two tandem engines together, or a twin tandem, one driver per shift. Tandem engines, *i.e.*, engines with two double-acting cylinders, are built in sizes of from 400 to 3,000 B.H.P., and the wages cost is relatively smaller for the larger sizes. The manager of one of the largest ironworks reports that in his own experience the cost of upkeep and repairs has been considerably less for gas plant than for steam plant of the same output. In the face of all this evidence, there can no longer be any justification for refusing to accept modern gas engines on the score of unreliability.

That there have been failures, goes without saying; but certain failures that have occurred have been almost invited, for they have been due to an improper choice of plant. Steam plant has been known to fail even when the engines have been copies or attempted copies of some well-proved design. With gas engines, as with steam engines, there are makers and makers, and it is the province of the engineer to select the right maker.

The author puts in a special plea for his own engine, to the effect that in all cases where the manager and staff have become familiar with the engine it has again been installed when an extension or alteration has become necessary.

Considering how immense has been the output of electrical machinery that the blast-furnace gas engine has brought about, it is a pity that our own ironmasters have done so little to help the electrical industry, and that the electrical engineer has in turn done so little towards persuading the ironmasters out of their time-worn groove. That an awakening is now in progress, however, may be gathered from the foregoing abstract of Mr. Gridley's paper, which indicates the vast possibilities of electrical development from waste heat.

* "The Nurnberg Gas Engine," by Richard Bechtel; paper read before the Birmingham Association of Mechanical Engineers.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Samples with Tender.

Among recent specifications issued for arc lamps was one in which 80 lamps in all were asked for, both alternating and continuous current. These lamps were to burn four in series, and the specification stated that four lamps of each sort, eight lamps in all, *must* be sent with the tender. It is therefore obvious that if there were 10 firms tendering for this contract, the total number of lamps supplied to satisfy the requirements for 80 lamps would be practically double that number.

As you, Sirs, have always taken up a strong position in regard to such improper clauses, we draw your attention to this matter in the hope that some way may be found to remove such unfair impositions from an industry which is already sufficiently handicapped.

One of the Tenderers.

[The samples would, presumably, have been returned, but the requirement in question was certainly unreasonable; after two or three tenders had been selected, it might have been in order, but not before.—EDS. E.R.]

X-Ray Tubes.

I am interested in the construction of a form of apparatus in which the maintenance of a constant degree of vacuum is essential, and shall be glad of any hints as to how this may best be ensured.

Is the phenomenon of the degree of vacuum increasing with use peculiar to X-ray tubes, as distinct from other forms of vacuum tubes; and, if so, why?

Jacey.

Electric Lighting Acts (Amendment) Bill.

The arguments put forward by "Another Borough Electrical Engineer" I am afraid will not create much support for a Bill intended to grant such wide powers as are demanded by the proposed Electric Lighting Acts (Amendment) Bill.

I always understood that the cry for statutory powers to do wiring work was based on the ground that it should be done on free wiring or instalment lines (otherwise as cheaply as possible) to compete with gas companies; it is news to me to learn that the powers are wanted to improve the quality of the wiring work as much as anything else.

Perhaps "Another Borough Electrical Engineer" can explain how the work of these plumbers, decorators, &c., is passed and connected up to his supply if the same is not up to his tests and rules, as his remarks would have everyone

infer. A very large amount of wiring is done by this class of workman at prices which would not pay a municipal wiring department or the writer, but all the same it gets connected up, and the legitimate contractor has to face this competition.

"Contractor's" contention is that it is practically impossible for a municipal wiring department to pay at the wiring prices prevailing to-day, and I am sure anyone intimately acquainted with this branch of electric lighting will agree with him.

"Borough Electrical Engineer" must live in some place unknown to the ordinary contractor, and I would advise him not to disclose his identity, otherwise his district may be invaded by a few more men anxious to find a spot where good work is appreciated, although probably not insisted on.

The lines on which he runs his free wiring department in conjunction with his two real electrical contractors (who, by the bye, do not sell electric lamps) are distinctly unique, and I would ask him for what purpose he employs a staff of electricians when they do not do the work they are specially engaged for? Free wiring by a corporation is to be done as cheaply as possible, consistent with a good installation, and surely a properly organised branch of wiremen, under the supervision of a competent engineer, ought to be able to do an installation at a lower cost than any contractor could, especially as the former has only to avoid making a loss, whilst the latter has to be sure of a profit.

I am unable to reply to "Another Borough Electrical Engineer's" question concerning the prospective electrical consumer who intends using gas for another year, as he puts forward no facts, giving only his own feelings on the matter; but even if there were dozens of these cases each year, and it was proved that in each case the consumer would have had electric light installed, it would be an expensive departure to install wiring departments to secure them.

"Borough Electrical Engineer" does not intend to see the strength of "Contractor's" arguments; if the positions were reversed, and the former could see a possibility of his losing his living and his money invested in his business through unnecessary and unwarranted encroachments by the latter, then perhaps he would admit that the 4s. 2d. in the £ or the 1d. rate is hardly the point at issue.

Municipalities do not need to speculate with the ratepayers' money by entering into this field, where competition is already so keen that its effect is felt on the quality of the work done; their representatives, the borough electrical engineers, could, with beneficial results to their respective stations, devote a little more of their attention to the business they are expected to manage by maintaining a *continuous* and *steady* supply, and by seeing that their consumers' installations are fitted up as they should be.

The materials used and the workmanship are seldom even superficially examined, and the test and the passing of the installation is left to the jointer and meter-fixer.

Repeatedly one can read in the daily papers of towns in darkness through burnt-out cables or machine breakdowns (faults which under proper management should not occur), and it is extinctions such as these which form the most powerful argument a canvasser has to meet when applying for new customers; he is not called upon to prove that his installation work will be done properly, but how will the electric light bill compare with the gas bill? and can the supply be relied upon now?

A large number of municipally-managed electric light stations do not pay for one or more reasons, and I think it is to be regretted that "Borough Electrical Engineer" and many of his colleagues should make such frantic efforts to start wiring departments when few contractors can even manage to scrape along. To expect the majority of these stations to become remunerative by the simple addition of a wiring section, which would have to stand up against an army of established contractors, fighting in many cases for their lives, is, in my opinion, very bad business.

I think if more of these stations were run by men with commercial as well as electrical experience, many of them would have a different tale to tell, and would not even attempt to hold wiring contractors responsible for the present state of their undertakings.

Municipal finance is generally regarded with suspicion, and to most people who come in contact with it, the prospect of any addition to present operations is cause for alarm.

As an illustration of what is going on to-day in the town from which I am writing, I will mention the following: The tramway department pays the electric light department (both municipal) about 20 per cent. more for its current per unit than an ordinary consumer can obtain it for for power purposes on certain rates; the tramway demand is a regular one, and can, of course, be estimated for in advance, yet a consumer with his uncertain consumption obtains better terms, and on lines such as these we must concede the wiring departments would be run and shown to pay.

Borough electrical engineers are responsible for the existence of the jerry wireman, and it is surprising that they cannot bring themselves to acknowledge this fact; if they wish to exterminate him, why not do it now with the weapons they are armed with?

Another Contractor.

Failures of Exciters.

I shall be glad to learn the many causes of this trouble, and how to remedy the same. The experience of some engineers who have had to contend with these difficulties would be welcome.

H. G. J. Barrow,
Colliery Manager.

Maesteg, *August 5th*, 1909.

TESTING CONDENSERS FOR LEAKAGES.

By "HARBEE."

Every year the number of condensing plants (chiefly surface condensers) installed is rapidly increasing, and competition is becoming keener between engine builders with regard to water consumption or pounds of water per B.H.P.-hour on the various engines. These tests are often carried to the third decimal place.

If this minute estimation is likely to continue, I think it high time we had it more widely known how simple, yet very reliable, tests can be made for leaky condensers. The makers' usual practice is to put a light water pressure, first on cooling surface side and afterwards on condensed water side, at the same time carefully looking out for any water trickling through.

The station engineer, if doubtful, will run condensing plant for several hours with only circulating water going through the cooling surface, and carefully note if any condensed water is thrown up by the pump. Both of these methods for ordinary working conditions may suffice, but for a close competitive test they would not be to my mind sufficiently accurate, because I have known the behaviour of leakages to be very different when both waters are going through, than when one only is used. My contention is that a condenser, like any other machine, should be tested under its full-load working conditions, and so far as I know, there is no mechanical means of doing this, it is purely one for chemistry and, personally, I consider the silver nitrate test for chlorine or chloride to be the most suitable.

Even in the hands of an amateur it is possible to trace salt in water, although it may be only one part of salt to one hundred-thousand parts of water. Therefore the leakage, however slight, is quickly disclosed by the test mentioned.

The water frequently used for cooling purposes is that generally known as surface water, drawn from rivers, canals, &c., and such is always found to contain, among other things, sodium chloride, or common salt, in variable quantities. This, together with the fact that condensed water should never contain sodium salts, enables one to make a very reliable test for any leakage in a condenser. To carry out the test, we shall require a standard solution of silver nitrate, which can be purchased from any qualified chemist, or to those who care to make it themselves, the particulars

are as follows :—Dissolve 2·394 grams of pure recrystallised silver nitrate in distilled water, and make solution up to 1 litre. We shall also require a solution of potassium chromate, made by dissolving potassium chromate in distilled water ; one part of chromate to 10 parts by weight of water.

This potassium chromate solution is used as a colour indicator. The principle upon which the indicator depends is that silver combines with chlorine in preference to chromic acid, and that accordingly no red chromate of silver is capable of being formed so long as chlorides are in the water, but that red chromate of silver instantly forms the moment nitrate of silver is in the slightest excess. Therefore, if we take a sample of water known to contain chlorine salts, and into this drop, spot by spot, the silver nitrate solution, a white precipitate of chloride of silver will form, and continue to do so, until all the chlorine in the water has been precipitated. But, as will be seen upon making the experiment, there is a difficulty in observing the exact point at which the formation of the precipitate ceases, and this difficulty is overcome by the use of the colour indicator, potassium chromate.

The details of analysis are as follows :—Measure out carefully 50 cubic centimetres of the condensed water, which should then be passed through a filter paper into a clean porcelain dish. To this add about half a dozen spots of the colour indicator, potassium chromate, at the same time stirring with a glass rod, the colour of the water then will be distinctly yellow ; this being so, the silver nitrate solution, which should be contained in a properly graduated burette, is carefully dropped, spot by spot, into the water, which should be constantly stirred the whole of the time. As will be observed, the first few spots will become red directly they touch the water and die away to a pale yellow on stirring, that is, if sodium chlorides are present. The dropping in of silver nitrate solution should be continued, as well as the stirring, until the water becomes permanently red.

The very earliest moment at which the chromate of silver begins to form, or the redness becomes persistent, the addition of silver solution should be stopped and the amount used read off from the graduated burette ; from this we can ascertain the quantity of salt present in the water.

One cubic centimetre of silver nitrate solution practically corresponds to one grain of salt per gallon of water. If on adding the first one or two spots of silver nitrate solution, the condensed water (which had previously been coloured by indicator) becomes permanently red, it is quite certain that there is little or no salt in the water, consequently the condenser may be considered quite bottle tight. If, on the other hand, it requires several cubic centimetres of silver nitrate solution to bring about a permanent red colour, then the condenser is certainly leaking ; to what extent may be judged by the quantity of salt found to be present.

NAVAL VOLTAGES.

On board a warship it is necessary to fix some standard of voltage that will serve a variety of purposes. The e are the ship lighting, the various motors, the searchlights ; and now even the gun and telephone circuits are beginning to derive their energy from the ship's dynamo.

The problem of settling what voltage is most suitable for general service purposes, is not quite so easy as it might appear at first sight. Until recently 80 volts was considered sufficient, but latterly it has been found necessary to increase this amount up to 200 and even more.

The reason why so low a voltage was originally selected is to be traced to the introduction of the searchlight. When men-of-war were first supplied with dynamos, the sole *raison d'être* of the dynamo was the searchlight ; accordingly all instruments were calibrated to suit the searchlight dynamo, the voltage of which was fixed by the requirements of an arc light, with the customary ample margin of safety to allow for contingencies.

The arc light requires at least 40 volts to work satisfactorily, was the argument ; there are certain losses to be allowed for ; also it may be desirable on occasion to burn the light at a distance from the ship, incurring further losses in the long feeders necessary. We can afford to be generous ; let us double the minimum voltage required.

Accordingly a searchlight resistance was designed to absorb the surplus, and 80 volts became the standard pressure.

Later, when electric light was introduced as an alternative to the "purser's dip," it was necessary to proceed with caution, as behoved the pioneers of a rash experiment.

Eighty-volt lamps were chosen, to suit the ship's dynamo, and on rare occasions, when steam was raised in the ship's boilers, the officers basked in the luxuriant brilliance of the Ediswan lamp. Slowly the electric light crept through the stages of luxury and convenience until it became a necessity, and the lighting of the ship became perhaps the most important duty that the dynamo performed. True, it could light the searchlight when required, but that was now quite a side issue.

Gradually experimental motors began to make their appearance. The manner in which the engineer had wrested the capstan from his grasp was always a sore point with the sailor, and it lay to the honour of the torpedo man to reclaim it. A cautious Admiralty at length presented the torpedo staff with an electric capstan to play about with. True, they refused to go to the expense of providing him with a really efficient toy, but since they placed it on the quarterdeck where it was not of much use to any one, this did not matter a great deal. If it was really required, the motor could be disconnected and bars shipped in the ordinary way for working it by hand.

The torpedo man, however, refused to be discouraged ; he made the best of circumstances, and, wading through an unmerciful amount of chaff, at length succeeded in getting a footing. Electric motors began to appear in all parts of the ship.

In the ammunition hoists, the turrets, and the ventilating plant step by step, hydraulic machinery and steam began to give place to electricity. Finally the boat hoist was recaptured from the engine room, after a stout resistance, and the engine-room staff was driven below, behind the armoured belt. The dynamos were further called upon to supply the initial current for wireless telegraphy—and all this on 80 volts. Through all its evolution from two poles to six, from gauze to carbon brushes, the Gramme ring, drum armature, lap winding and wave, the dynamo sang its old refrain, "Forty volts for the arc light and forty to spare." No matter that the distant glow lamps began to grow dim, and the motors ran slow. Larger cross-section in the feeders and lower voltage lamps, was the reply. But this sort of thing could not go on indefinitely. Desperate characters among the torpedo staff urged a few more revolutions out of their dynamos and manipulated their instruments. It was whispered that voltmeters had come back to the dockyards registering as much as 5 volts under standard, and engineers began to complain about the coal consumed for the number of watt-hours logged.

The matter was serious, and called for immediate action. Something had to be done, and the Admiralty decided to do it handsomely ; with unprecedented generosity they presented the torpedo staff with another 120 volts.

It was a big leap ; the note of the dynamo became changed. The glow lamps, the motors, the wireless transformer, was the cry, let the searchlights come in where they can.

And now mark the irony of fate. The two searchlights, one on either side of the bridge, have been multiplied by four ; the wireless transformer has given place to a motor alternator. Busybodies are introducing low-voltage lamps of high efficiency which bid fair to oust the carbon-filament lamp, dynamo firing has superseded battery power at the guns, and even the communication system, fire control, bells and telephones are going to the dynamo for their energy. All these things demand low voltages, and what has been saved in lighter wiring may be more than counterbalanced by weighty motor transformers, which are springing up everywhere and occupying much valuable space within the armoured belt.

The time is not far distant when all guns will be electrically trained, more ammunition will have to be carried, and its supply by electric power will have to be accelerated. Already electricity has displaced hydraulic

power in the turrets of one of our latest warships. Everywhere electricity is in demand; the bigger the ship, the longer the wiring and the stronger the demand for a margin of voltage.

What, then, is to be the terminal voltage of the main dynamo? On what is it to be based? Forty volts for the searchlight is a cry which still makes itself heard, and cannot be disregarded; 200 amperes is the least that must be supplied in the way of current, and with high voltages and eight arcs or more to deal with, a large surplus is no insignificant matter to handle.

The old-fashioned seamanship with its hundred uses for a single spar was built upon the solid foundation of experience and necessity; it accepted an appliance for what it was worth, in the work for which it was designed, as a starting point, and then began to enlarge its field of application. The same spirit that saw in the spare topmast, a jury rudder, a lifting derrick, and a spare mainyard as well, has elevated the little searchlight dynamo to a far more dignified position. We live in an age of experiment and reform, but, though the older methods of advance by measured stages may have erred on the side of caution, they were founded on material solid to the core.

LEGAL.

Devonport Corporation *v.* Devonport and District Tramways Co.

Judgment was given at Devonport Police Court on Wednesday last week in this case, which was reported in our last issue.

Dr G. A. Rae, in giving judgment, said there were two sets of summonses, one for non-running of the service of cars as required by the Corporation in the public interest, and the second for the non-supply of the workmen's cars, as specified and required. The Court found against the defendant company, in both cases, and fined the company the maximum—£5—and costs for the first day in the first set of summonses. There were 83 summonses of the same character following that, and in those the fine was 2s. 6d. and costs for each day. On the second set there were 71 summonses; the company would be fined £2 and costs for the first day for non-running of workmen's cars, and for the subsequent dates 1s. and costs in each case.

On Friday Mr. T. H. Gill applied to the Bench to grant a special case for appeal in respect of the decision, for the determination of the King's Bench Division, as the defendants alleged that the decision that the magistrates gave was erroneous in law.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

30-Amp. Fuse-Switch.

The British Electric Calibrated Fuse Co., Harpenden, have sent us particulars of a fuse-switch, designed for small capacities. It is manufactured only in one size, and can be fitted with calibrated fuses up to 30 amps., 500 volts. The cast-iron case is securely fastened with a small brass clip, which opens with a touch of the finger, and when the box is opened the circuit is automatically broken. When replacing a fuse, no screws have to be touched, the fuses being held in specially-designed phosphor-bronze clips. The operation of renewing a fuse takes only one second. The cast-iron box is lined throughout with asbestos, and the slates are also insulated from the box by bushes.

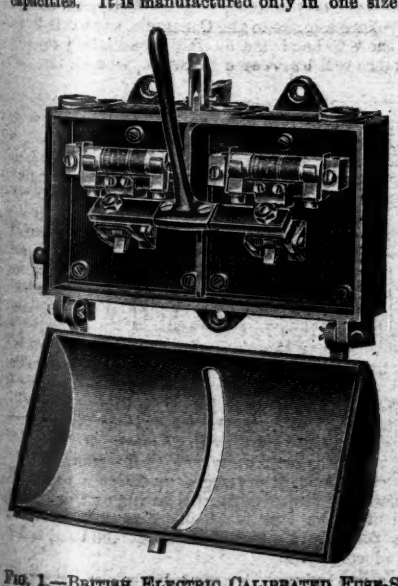

Fig. 1.—British Electric Calibrated Fuse-Switch.

The only part of the switch which has any tendency to wear is a small leaf that makes contact between the main terminals and the fuse; this is readily renewed by the users themselves. Simplicity and compactness are obvious features of the design.

"Cantie" Switches.

The "Cantie" Switch Manufacturing Co., of 67, Mount Street, Nottingham, send us particulars of their latest line in switches—the "Cantie" patent switch No. 3. The construction of this device is shown in the accompanying fig. 2. The switch is mounted on a strong non-hygroscopic china base, provided with fillets and a central division, which make it very difficult to touch a live part when the switch is off. The switch itself is of the knife pattern, but, thanks to the ingenious arrangement at the pivot, the blade is given a longitudinal motion in the contact jaws as well as a radial

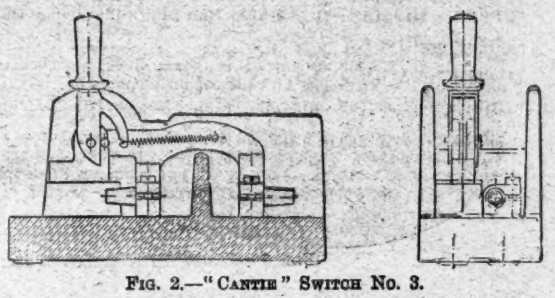

Fig. 2.—"Cantie" Switch No. 3.

motion, and snaps in or out; there is no possibility of producing an arc. The contacts are of phosphor-bronze, with a smooth bend of new form, and are so designed that both front and back contacts break at the same time. The sweating thimbles for the cable ends fit closely into split holes, and cannot work loose when once tightened in position. The 25-amp. size here illustrated has been tested at the National Physical Laboratory, and reported on as suitable for 500 volts; the insulation resistance was over 100 megohms.

The switch is also to be had mounted in a watertight cast-iron self-locking case, which cannot be opened unless the switch is off; nor can the switch be put on till the case is closed. The joint is made with tallowed asbestos in a groove, and the spindle is also packed with asbestos, while the lead holes are tapped for conduit. Fig. 3 shows the watertight switch and fuse, the case just described being enlarged to receive the two fuses. The connecting bars are of mica.

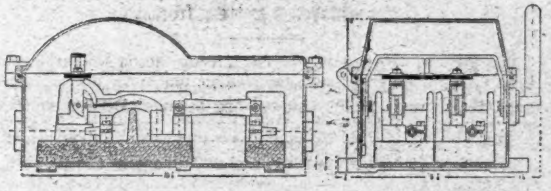

Fig. 3.—"Cantie" No. 3 Double-Pole Switch and Fuse.

We have examined samples of both the switches illustrated, and have no hesitation in expressing approval of the design.

Bamag Elastic Couplings.

Mr. C. A. Matthews, of 12, Newport Road, Chorlton-cum-Hardy, agent for the "Bamag" couplings in the North of England and Scotland, has sent us particulars of these devices. The coupling consists essentially of a pair of disks with axial holes *f*, fig. 4, near the circumference, into which are fitted studs of leather or rubber, *e*; the

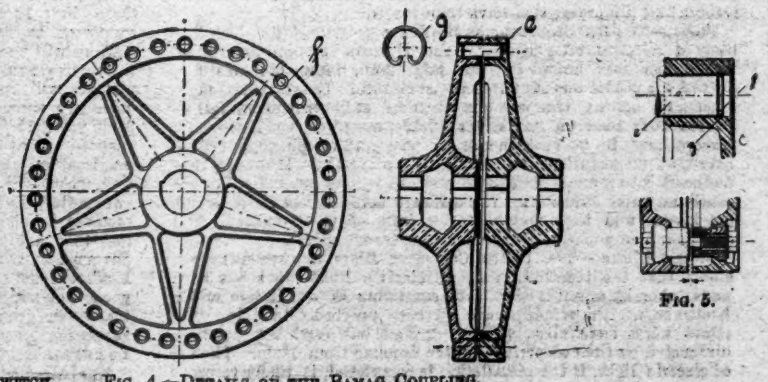

Fig. 4.—Details of the Bamag Coupling.

Fig. 5.

torque is transmitted through these studs, which are in shear, the large radius being adopted to reduce the stress upon them. The studs are held in place by spring rings fitting into grooves, as at *g*, figs. 4. and 5. If desired, spring joints can be provided, as in fig. 5, which permit of slight longitudinal movements of the shafts without allowing them to touch; this is especially recommended for electrical driving. In larger sizes the disks are made of cast-steel, up to 9 ft. in diameter, with a correspondingly increased number of studs; a coupling of this size can transmit normally nearly 7,000 H.P.

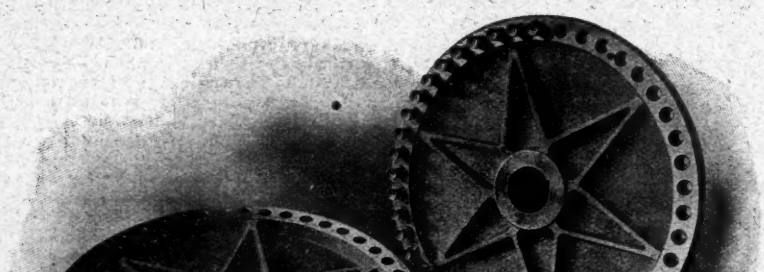

Fig. 6.—Bamag Elastic Coupling.

continuously, and weighs rather more than 7 tons. Such couplings are suitable for rolling mills and haulage machinery, and have been used to transmit 5,000 H.P. at 108 R.P.M., in an ironworks. Fig. 6 shows the steel disks and the studs separated.

The couplings are suitable for reversing drives, and are readily unshipped when required, without moving the shafts; uncoupling can be effected by taking out the studs. Momentary overloads of 100 per cent. can be carried, and 20 per cent. overload can safely be transmitted for half an hour.

BUSINESS NOTES.

Consular Notes.—Japan.—The British Consul at Osaka reports that in the supply of electrical machinery, equipment, &c., there is active competition between British, American and German manufacturers. Until recently an American firm had practically a monopoly in the district, but latterly British and German firms have secured contracts. With the opening up of electric railways and the extension of various electric light companies it is probable that large quantities of electrical machinery, &c., will be required during the next few years. Generally speaking, the engines and boilers in Osaka factories are of British make. At present there is considerable demand for boilers made by a British firm, who seem likely to secure a monopoly in the future. It is impossible for British manufacturers to secure contracts for machinery, &c., unless they have an experienced representative on the spot, as a knowledge of local and personal considerations and the methods of tendering is absolutely essential.

Portugal.—The British Consul at Oporto reports that considerable attention is now being paid in Portugal to the matter of the utilisation of water-power. Some water-power is already being utilised for industrial and lighting purposes, and its development in the near future is likely to be considerable. The Consul states that, to the best of his knowledge, the Swiss and German manufacturers of both turbines and electrical machinery have so far received all the orders that have been placed.

Peru.—The British Consul at Iquitos reports that the installation of wireless telegraphy of the German system known as Telefunken was completed on July 28th, 1908, but was not opened for public service till September 15th. It has proved very successful, but as the wireless stations only extend as far as Puerto Bermudez on the River Pichio, messages for Lima and Europe have to be sent thence by wire and telephone, and it is here that interruptions are continually occurring. However, it is understood that one or two more stations will be erected to ensure continual communication. The distance between towers is about 300 kiloms, and their height varies from 45 to 65 metres. The price charged per word to Lima is 44 c. (about 10½d.).

Mozambique.—The British Consul at Beira, in a recent report, states that the installation of an electric light plant has been undertaken by a partnership firm consisting of an Italian and a Frenchman. The supplies have all been purchased in Italy. The street wires have already been erected, but further progress is obstructed by the non-arrival of the dynamo from Italy. The use of electric light, if the installation is completed, is likely to prove an expensive luxury to the consumer.

The British Consular Agent at Quilimane reports that during 1908 commerce has benefited much through the opening of a British cable station at Quilimane which places that town in direct communication with the outer world; the result is that telegrams now reach their destination, which was not always the case previously.

Turkey.—The British Consul at Adana reports that electric appliances were in the past supplied by Germans, but there is no reason why British firms should not enter the market. There are two projects for utilising water power for light and power at Adana, Tarsus and Mersina. Tarsus has already an installation of electric light set up by a Swiss engineer. Of the two projects for light and power, details, as far as obtainable, have been sent to the Board of Trade. The other project—which the Consul fears is a rival one—is for 3,000 H.P. from water turbines some eight miles from Tarsus. The promoter is the owner of the new cotton mill at Tarsus. The Swiss engineer already on the spot has, the Consul believes, the order for the machines should the concession be granted, but he does not know if the bargain is concluded. In addition to these large projects electrical appliances of all sorts will be wanted in the three towns when and if light and power arrive.

Siam.—In a report on the Western Siamese States, H.M. Consul states that the prospects of rubber in Kedah are excellent, but only one estate has any trees of a tappable age at present. The majority of the trees are from two to four years old, but all are looking very well, even when planted in what would appear to be an uncongenial soil. The great difficulty which planters have to contend with is the labour supply, as the local labour is unsatisfactory, and the Straits Government do their best in accordance with the agreement with India to prevent Tamil coolies from migrating to Kedah where they are beyond the paternal care of the British Government. If Kedah is to become a protected State of the United Kingdom, the difficulty will doubtless cease to exist, and Kedah will obtain all the Tamil labour she requires. Another much-felt-want is a proper survey, and as a result, sound title deeds.

The Azores.—The British Consul reports that in the summer of 1908, operations were commenced for the establishment of wireless telegraph stations at Ponta Delgada and St. Mary's, and when these are completed, stations will also be opened on some of the other islands.

Italy.—The British Consul at Genoa reports that the Italian State railway has given the work of electrification of the Campasso-Busalla line to the Westinghouse Co. at Vado. This line carries the traffic from Genoa to Piedmont, Lombardy, the Venetian provinces and Switzerland, and runs parallel to the other line, carrying similar traffic, as far as Ronco, where the two join. The length of the electric line will be 11½ miles, and it will be a double track throughout. The steam power for the generating station will be supplied with boilers and with turbo-generators and switchboards manufactured in England. For the four transformer sub-stations the switchboards will also be procured from England, while the transformers—four single-phase for each sub-station—will be manufactured at Vado. Elsewhere in his report the Consul states that a Marconi wireless station has been erected at the end of the Molo Vecchio at Genoa, but is not yet working. Adjoining is a workshop for mounting and repairing wireless plant and apparatus; as it is the only one in the Mediterranean, the Consorzio has granted special facilities to Mr. Marconi. New electric grab and hydraulic cranes have been erected on the piers, which, effecting an economy in cost of discharge, are a profit to the Consorzio, so that it is proposed to order 13 more to be placed on the Caracciolo jetty when finished; these cranes will be ordered in Berlin, whence the others came.

The British Vice-Consul at Savona reports that the electrification of the Savona-San Giuseppe Railway line, about 13 miles long, has been definitely decided on by the Italian State Railway. The steam electric central station will probably be built at Vado, a village 3 miles from Savona. The plant will consist of two turbo-generator groups of 5,000 KW. each, producing an electric current at 13,000 volts, three-phase, 15 periods, carried to the line by two principal feeders, supported by iron poles with wire of $\frac{1}{16}$ in. diameter. Four sub-stations will be erected. A decision has not yet been taken as to which overhead line system will be adopted. The electric locomotives will be of the five-axle type, all coupled and provided with two three-phase motors with direct action at the tension of 3,000 volts, 15 periods. These locomotives will have two normal speeds—one of 14 miles and the other of 28 miles—which will be obtained in the first case by inserting the two motors in cascade connection with each other, and in the second by connecting the two motors in parallel. The order for 15 of these electric locomotives has been placed with the Società Italiana Westinghouse, and they are already being built at their works at Vadò. The Savona-San Giuseppe line will carry the traffic from Savona to Piedmont, 38 goods and eight passenger up trains a day, and 15 goods and six passenger down trains, will be run on this line; the maximum gradient to be met is of about 25 per 1,000. The ascending goods trains have a weight of about 400 tons, and will be hauled by two locomotives.

Spain.—The British Consul at Corunna reports that the lighting of the town is undertaken by two companies, the Société d'Eclairage de la Corogne et Vigo and the Sociedad Co-operativa Electrica, which both receive their power from the same source—a stream near Puentedueme, near Ferrol. Great competition existed between

these two companies by which the consumer benefited, but they have now come to an arrangement and work together. The lamps and fittings employed all come from Germany, and are supplied by agencies in Madrid. The number of lamps used annually is about 55,000, and they are nearly all of the bayonet-holder pattern.

The British Consul at Gijon reports that the tramways in that town have been taken over by one of the Thomson-Houston companies, and are now being converted from horse to electric traction. No extension of the line worthy of mention is to be made at present, but as soon as the new Government road from Gijon to the port of Musel is open, it is proposed to run a line to that harbour.

China.—The British Consul at Tientsin reports that, within the last two or three years, the system of tramways worked by the Cie de Tramway et d'Eclairage Electriques de Tientsin, a Belgian company, has been considerably extended. Originally designed only to make a circuit round the Chinese city along the boulevards formed by the demolition of the old city walls, with an extension along the Chinese Bund, the system was carried across the river to the Austrian concession by a bridge opened in November, 1906; and in May, 1907, an agreement was concluded with the Japanese concession for running the line through the main street of that concession and thus providing a direct route between the foreign settlements and the Chinese city apart from the route through the Russian, Italian and Austrian concessions on the other side of the river. Until this extension was carried out, the tramways did not pay, but it is now believed that their success in the future is assured. There are between 8 and 9 miles open to traffic, nearly all double track. The receipts from the tramways alone are given as £13,120 in 1907 and £19,400 in 1908, but the Consul has been unable to ascertain the cost of working. The electric lighting business of this company has also greatly increased. In 1907 the receipts were £4,680 and in 1908, £6,240.

The British Consul at Chungking reports that the Chungking Electric Light Co., a Chinese company, started operations on a small scale in June, 1908. They are running 220 lamps of 16-c.p. each, and the dynamo is driven by a 5-in. belt from a small vertical engine of about 22-H.P. The company is now considering tenders from various firms for the erection of a big plant to light the whole city, and a piece of ground has been bought outside the Tai Ping Men on which to erect the plant.

The British Consul at Wuhu reports that a Chinese company was formed there some two years ago to supply the town with electric light, and expected to commence operations early in April, 1909.

United States.—The British Consul at St. Louis reports that the output of electric cars during 1908 was not more than one-third to one-half of the usual number turned out. Passenger coaches for steam railway service have been one of the features of the industry, but during the past year only a few were manufactured. A loss of more than 50 per cent. is to be noted, approximate value being about £60,000. Of new cars made and those repaired, the business for the year amounted to not more than one-fourth its usual volume, or a total of about £1,200,000, making the car-building industry of St. Louis for 1908 about £1,800,000.

The British Consul at Baltimore reports that the Winchester and Washington Electric Railway Co. has constructed a dam of concrete across the Shenandoah River at Millville, Jefferson County, West Virginia, about 10 miles south of Harper's Ferry. It is built on a rock foundation; its length is 1,000 ft., and it is 12 ft. in width at the bottom and 4 ft. at the top. The cost is given at £61,700. It is used for furnishing power that operates an electric light and power plant which supplies Winchester, Virginia and other places, and as far as Harper's Ferry, over high-tension lines at 22,000 volts. The construction of the dam across the Susquehanna River at McCall's Ferry has ceased for the present, owing, it is said, to the money stringency.

The British Vice-Consul at Richmond reports that there are 457 miles of electric railway in operation in Virginia, of which 30 miles were constructed during the year 1907. The total earnings were £755,804, the percentage of expenses to earnings being 70·86. The average daily wage to the 3,581 employés was 7s. 7d.

French West Africa.—The British Consul at Sakar reports that the total amount of rubber exported from French West Africa during 1907 was 3,713 tons, valued at 30,000,000 fr., equal to £1,200,000. The rubber industry has been seriously depressed during the last two years, prices in Europe having dropped from 12·50 fr. (10s.), to as low as 4·50 fr. (3s. 7½d.) per kg. The Ivory Coast and French Guinea are the principal rubber producers in French West Africa, and the crisis in the rubber industry was severely felt by merchants and importers of these Colonies. The price paid to the native gatherers of rubber, which in ordinary years was on an average 7 fr. per kg., was reduced during 1907 and 1908 to 3 fr. per kg., an amount about sufficient to enable him to pay his taxes, but insufficient to allow him to purchase imported manufactured articles. The chief exporting ports are Assinie, Bassam, Labon and Sassandra on the Ivory Coast; Conakry, in Guinea; and Ziguinchor, Dakar and St. Louis, in Senegal. The exports from Togo and Portuguese Guinea amounted to 164 and 224 tons respectively in 1907, and to 147 tons from the former in 1908.

Brazil.—The British Consul at Santos reports that it may be affirmed that the State of Sao Paulo has been the cradle of the utilisation of hydraulic power in Brazil for generating electricity; that at present turned to account, however, is but insignificant in comparison with the immense undeveloped resources which the State possesses in the numerous large waterfalls, mostly State property, and to a large extent still unexplored. The principal hydro-electric stations constructed in the State are that of the Sao Paulo Tramway, Light and Power Co., at Parnahyba, with a capacity of 8,000 H.P., and those of various other companies, viz.:—At Jundiahy, generating 1,000 KW.; Sorocaba, generating 1,000 KW.; Rio Claro, generating 580 KW.; Mococa, generating 500 KW.; Peracicaba, generating 450 KW.

The important hydro-electric station in course of construction by the Santos Dock Co. at the Italinga Falls near to Santos, which should be completed in a year's time, will transform and transmit electric energy of 3,000 KW., which will be used in working the cranes on the quay at Santos, and the supply of light and power to that city. The principal waterfalls surveyed, but so far not utilised, are:—On the River Parana: Urubu Punga 447,000 H.P. On the River Grande: Patos 400,000 H.P., Maribondo 61,000 H.P., Avanhandava 57,700 H.P., Itapura 40,000 H.P., Juqueryquere 40,000 H.P., Cruzes 40,000 H.P., Ilha Secca 40,000 H.P.

The British Vice-Consul at Curityba reports that the only existing tramway line is worked by mule traction. The company has the concession to electrify the line and to extend it to neighbouring towns and villages. It is petitioning the State and municipal Government to assist by giving a guarantee on the necessary capital. Until now no work has been begun. The most important enterprise in this branch of industry is the Empresa de Electricidad de Curityba, which possesses a concession for 30 years to supply the electric light to the capital. The company is German, and nearly all the material used is of German origin. It is doing well, and last year made 20 per cent. net profit on the capital invested. The same enterprise has another concession for 50 years, to explore the waterfall of Cayacanga, on the River Iguassu, distant 40 miles from Curityba, for the production of electric light and power. There are several electric plants in other towns through the State, and others are in construction. They are generally built by Germans, and with German material.

The British Consul at Porto Alegre reports that during the year 1908 the municipality completed the installation of an electric lighting system principally for the public illumination of the suburbs and parts of the city not lighted by gas. A very limited number of private consumers is also supplied where gas cannot be obtained, but the installation is not large enough to supply electric lighting in a general way. A concession for supplying electric light to private consumers within a limited zone of the city, was held by a native company (Fiat Lux), but expired in April, 1909, and the whole of the town and suburbs is open to all comers.

Russia.—The British Consul at Odessa reports that, in spite of the Government approval of their scheme for the electrification of the Odessa tramways, the tramway company have not yet been able to begin work owing to fresh preliminary difficulties. The tender of the Société Anonyme des Tramways d'Odessa was accepted for the construction of an electric supply station. A telegraph cable was laid from Sevastopol to Varna by a British firm during 1908, and it began work on August 2nd of that year.

The British Vice-Consul at Nicolaieff reports that although the Town Council decided in principle to grant a concession for the electrification of the existing horse tramways in May, 1908, nothing definite has as yet been settled. The Government has assigned a sum of money for the improvement of the existing telegraph and telephone communication between Nicolaieff and Odessa. This work should be undertaken during 1909.

The British Vice-Consul at Kharkov reports that an electric tramway was built some years ago by the municipality to the goods station of the South-Eastern Railway, but in the rest of the town, and to the fine Central Railway Station, a Belgian company runs dilapidated horse tramways. The proposal of this company to introduce electric traction on the condition of extension for another 31 years of the existing concession is now being hotly discussed, but it is likely to be refused, although the municipality cannot provide the funds for the improvement independently.

The British Vice-Consul at Kherson reports that the municipality are now discussing the terms of a concession to French capitalists for building electric tramways in the town and to the railway station, of an aggregate length of about 11½ miles. The electric lighting of the town and port was put into operation in March, 1909.

The British Vice-Consul at Sevastopol reports that the project of an electric railway to Jalta and the south coast, which has been under consideration for some years, is now coming somewhat more to the front. Surveys and estimates have been made, and three different routes are projected; one is from Simpheropol to Aloushta and Jalta, another from Bachtchi-Serai to Jalta, and a third to Sevastopol by way of Balaclava and the south coast. The cost of the line, according to whichever route may be decided upon, is estimated at 10,000,000 to 15,000,000 roubles (£1,055,000 to £1,583,000). A society has been formed in St. Petersburg with the object of forming a share company of electric railways in the Crimea, but the necessary capital seems hard to find, and the Government seems disposed to grant a concession to a Russian company only.

Simplex Lamps.—Messrs. Simplex Conduits, Ltd., inform us that they can now supply high-voltage lamps of 25 c.p., suitable for burning direct on circuits from 200 to 250 volts.

Annual Outing.—The employés of Messrs. Cox-Walkers, Ltd., had their annual excursion to Scarborough on Saturday, July 31st.

Heywood Contract Arbitration.—The award of the arbitrator (Mr. S. L. Pearce) in the matter of the Heywood Corporation and Messrs. Whipp & Bourne, with respect to the contract for the supply of a balancer booster set, is against the Corporation.

Russian Platinum Agreements.—A further stage in connection with the Russian platinum question is reported from Paris as having been reached between the Compagnie Industrielle

du Platine and the Demidoff heirs. The negotiations between the two parties, which were suspended some time ago in consequence of legal difficulties, were recently resumed, and have led, it is stated, to the conclusion of an understanding between the company and M. Ratkoff, manager of the Russian undertaking, which only requires the settlement of details to complete the agreement. The understanding desired on both sides has been difficult to arrive at on account of legal considerations, as the Demidoff heirs are not owners of the mine, but only have a provisional and non-defined right of working, which can at any time be ended by the Russian Government under certain preliminary conditions. On the basis of the new arrangement it is now proposed, with the full consent of the Government, to conclude an agreement whereby the Compagnie Industrielle will take over the ore produced in the mine from the present holders, and this agreement would remain in force in the case of their successors. This agreement is to come into operation on the expiration of the existing contract between the Demidoff heirs and a London firm. By means of the agreement the French company is to obtain a more effective control over the market, especially as the company will then devote attention by improved organisation to the reduction of the thefts at the mine, which are declared to be extensive. The company will make large advances to the Russian undertaking by the creation of fresh bond capital, which will be all the more easily raised, as the existing bonds, excepting a small sum, have already been redeemed.

Book Notices.—*Electric Storage Batteries for Load Peaks at Power Stations.*—In this little brochure, recently sent us by the D.P. Battery Co., Ltd., of Bakewell, an attempt is made to drive home certain facts and to expose certain fallacies in connection with the use of storage in electricity works. The undoubted fact, for instance, that a storage battery is the most reliable source of electrical energy that can possibly be installed is emphasised; the readiness of manufacturers to undertake the maintenance of batteries at their full capacity at a rate of about 7 per cent. on their capital cost (on a 10-year basis) is proof of their durability, and while their efficiency, considered alone, is admittedly only 70 to 75 per cent., the effective efficiency is a totally different matter; for not only does the inefficiency of the battery affect only a small proportion of the total output (that constituting the "peak") but, in addition, the battery is usually charged under conditions which enable the cost of the charging energy to be reduced to a fraction of the usual generating cost, thus practically counteracting the inefficiency. Following the paper read last year by Mr. A. M. Taylor, and the discussion thereon, the company builds up a strong case in favour of the storage battery, and drives it home with a practical example of material reduction of fuel consumption per unit generated by a Diesel set, due to the installation of a battery.

The Press Album. Edited by Thos. Catling. London: John Murray. 1909. Price 21s. net.—This handsome volume is a symposium by various well-known authors, artists and others, issued in aid of the journalists' orphan fund, which was founded in 1892, and has done admirable work. The proposal to bring out the book originated at a Press dinner, and was warmly taken up on every hand; the only difficulty arose in connection with the title, with which, however, we see no reason to quarrel. The album (*édition de luxe*) is bound in white and gold, and has for frontispiece a portrait in colours of His Majesty the King. The contents include many beautiful collotypes, half-tones and other illustrations, some now published for the first time; numerous autographs testify to the interest of distinguished men in various walks of life in the Orphan Fund, while the bulk of the contents consists of short stories, poems and essays by well-known authors. Apart altogether from its charitable purpose, the book is well worth purchase on its own merits, and we recommend it to our readers on the double basis—by buying it they will minister to their own pleasure, and will at the same time benefit the fatherless children on whose behalf it was produced.

American Street Railway Investments. 1909 Edition. New York: McGraw Publishing Co. $5.—This is the sixteenth annual volume of what is known as the American Electric Railway Red Book. It is, as most of our readers are aware, a big volume of some hundreds of pages issued yearly by the publishers of the *Electric Railway Journal*, and it is used mainly by bankers, brokers, capitalists, investors and others interested in street and interurban railway companies in the States. It contains many maps, and an abundance of general and financial information relating to more than 1,500 operating and controlled companies in the States and Canada.

"Proceedings of the Forty-second Annual Convention of the American Institute of Architects." "Annuary of the American Institute of Architects for 1909." Washington: The Institute.

"Year Book of the Michigan College of Mines." 1908-9. Houghton, Mich.: From the College.

"Electrical Installations." By Rankin Kennedy. Vol. V. London: Caxton Publishing Co. 1909. Price 7s. 6d. net per vol.

"Patents and Marks in all Republics of Latin America." 1909. By Messrs. Leclerc & Co., Rio de Janeiro, Brazil.

Stoker Contracts.—We have received a list of orders recently booked by the Underfeed Stoker Co. for stokers for a number of works and buildings, including the following:—General Post Office, Mount Pleasant; City of Carlisle Corporation; City of Bath Corporation (repeat order).

Bankruptcy Proceedings.—Under the failure of Charles Scott Snell, civil and electrical engineer, 25, Victoria Street, S.W., the first meeting of creditors was held on Monday last at the London Bankruptcy Court, before Mr. W. Boyle, Official Receiver. The statement of affairs submitted by the debtor showed total liabilities £13,588, of which £8,588 is unsecured, and assets, "a doubtful book debt, £75." When before the Examiner, the debtor stated that up to 1895 he was employed on various electrical and incandescent-gas matters. In 1899 or 1900 he invented a gas lamp and sold the patent to a company registered as the Scott Snell Gas Lamp Co., Ltd., with a nominal capital of £1,000,000. As vendor he received £9,000 preference, and £250,000 ordinary shares, and £4,000 cash, and he was appointed director at a remuneration of £500 per annum. The company had an existence of only three years when, owing to insufficient working capital, it was wound up by the Official Receiver in Companies' Department. The assets realised insufficient to meet the claims of the debenture holders, and no dividend was paid to the shareholders. The failure of the company left him without means, and with an indebtedness of £8,000 to the London Joint Stock Bank. Since then he had spent his time in inventing things, but had earned very little, and had lived mainly on money borrowed from friends. The inventions included a steam boiler, now derelict; a bolt, which was provisionally protected, but of no value; a vacuum gas compressor, which he sold to the Vacuum Gas Compressor, Ltd., for £900 shares, also now of no value; and an apparatus for public amusement in the shape of a patent captive aeroplane. He sold the latter invention to the Scott Snell Scenic Aeroplane, Ltd., but it happened that it had been anticipated, and the share consideration that he received was valueless. The debtor added that when he was a director of the Scott Snell Gas Lamp Co., Ltd., and was worth £50,000, he bought an estate at Wimbledon for £8,000, the money being advanced by the London Joint Stock Bank on the security of his shares in the company and a mortgage on the freehold property. The bank are returned as unsecured creditors to the extent of £3,000, owing to depreciation in the value of the property and shares. The debtor attributes his insolvency to the failure of the Scott Snell Gas Lamp Co., Ltd. In the absence of any proposal, the case was left in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy.

The creditors of J. W. Sydenham, 65, Seymour Street, W., met on Tuesday, at the London Bankruptcy Court, before Mr. Walter Boyle, Assistant OfficialReceiver, who reported that the debtor had stated when before the Examiner that he had never been in business on his own account, but had been engaged as an electrical engineer on the commercial side by various electrical companies. Whilst so engaged in Edinburgh he was led into dealings on the Stock Exchange, and he owed £365 in respect of differences. He had no personal debts and no assets. In the absence of any offer, the case was left with the Official Receiver to be wound up in the ordinary course of bankruptcy.

On the same day the first meeting of creditors was held under a receiving order made against Fordyce James Sheridan, 5, Ingram Court, Fenchurch Street, E.C., who assisted in the flotation of various electrical and motor undertakings. Mr. Walter Boyle, who again presided, reported that it appeared from the debtor's statements when before the Examiner, that this was his second appearance in the court. He was bankrupt in 1897 or 1898, with total liabilities £57,000; no dividend was then paid, and he had not applied for a discharge from those proceedings. He had since earned a living by assisting in the flotation of various public companies and in introducing businesses to purchasers. Among the companies which he had asisted to promote were the Electric Railways Co, Ltd., which was registered about nine years ago, and had gone into liquidation: the Brighton Electric Railway and Motor Roads, Ltd., and the Great Eastern Omnibus Co., Ltd. In the case of the Brighton Electric Railways, he assisted with advice respecting the Bill in Parliament; the Bill was thrown out, and no company was formed. The Parliamentary Bill for the Motor Roads, Ltd., only reached the Standing Orders stage, and was abandoned, but the Great Eastern Omnibus Co., Ltd., was floated two years ago, and had become a flourishing concern. He, however, now had no interest whatever in it. He had been engaged in some other matters of the same nature, but they came to nothing. The present bankruptcy proceedings were brought against him by the assignee of a judgment debt, which he disputed, and had unsuccessfully appealed against. He now owed £1,509, and had no assets whatever. The present bankruptcy was due to the failure of the various enterprises in which he had been interested.

In the absence of any offer the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

W. T. Garnett, electric cable and wire manufacturer, Bradford.—A second and final dividend of 9½d. in the £ is payable on August 18th.

Catalogues and Lists.—The Hagen Accumulator Works, 41, Snow Hill, Holborn Viaduct, E.C.—Illustrated pamphlet, giving prices, dimensions and other tabulated figures relating to the Hagen accumulators in celluloid, ebonite, glass and lead boxes for motor-cars, cycles, boats and other purposes.

Messrs. Haslam & Schontheil, Western Mail Chambers, Cardiff.—New list of 10 pages, giving illustrations of a variety of their cast-iron water-tight fittings—single-light vertical, cluster, hand lamps, also cast-iron guards for bulkhead or sconce fittings, and fuse boxes. Prices are clearly indicated in close proximity to the illustrations.

The United Electric Car Co., Ltd., Preston.—Illustrated pamphlet describing the Preston semi-convertible car—a closed car, an ordinary drop-sash car and a semi-convertible car combined. When the side lights are lowered, there is a clear opening of nearly 4 ft.; when the top light only is lowered, there is a clear opening of 1½ ft. The sashes work in a very simple manner, and when lowered drop into a narrow pocket, no seating room being lost.

The roof is not affected in any way, and the window arrangement can readily be adapted for single-deck or top-seat cars of the ordinary English design. The car illustrated is intended for South America and other countries where a semi-convertible is required.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—Leaflets relating to the "Metaflect" lamp, new electric flashing signs, and new 25-c.p. high-voltage tantalum lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Pamphlets describing, with prices, carbon-filament lamps of various patterns, including tubular and radiator lamps and coloured lamp varnishes; Siemens tantalum lamps, suitable for both direct and a.c. circuits, with adapters, fittings, &c.; and "wireless" electric light fittings, in which the cluster body is supplied complete with internal connections ready made, according to requirements. The last-named list, No. 29B, shows a variety of wireless clusters, "tantalum arcs," lanterns and reflectors for indoor and outdoor use.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet relating to the "Eclipse" metallic-filament lamp, with particulars and prices.

Messrs. Neville Kaye & Co., Ltd., 231-2, Strand, W.C.—Illustrated pamphlet drawing attention to the firm's electric lift gear, pulley blocks and overhead travelling cranes.

Edmundson's Electricity Corporation, Ltd., Broad Sanctuary Chambers, Tothill Street, Westminster.—Thirty-two page pamphlet entitled "Electric Light and Power," wherein the company gives a good deal of well-illustrated matter regarding electric lighting, heating and power installation work that it is prepared to undertake for country and town mansions, public buildings, factories and so forth. Suction gas plants, small water turbine, oil and petrol sets are briefly outlined. A full and imposing list of some of the clients for whom the company has installed electrical plant occupies a number of pages. The intention of the company to again develop this department of its business was referred to by the chairman in his speech at the recent annual meeting.

Messrs. Francis & Sons, 41, Hampden Street, Bolton.—List relating to the Francis (patent) hand-feed arc and proscenium lamps for stage work.

Condensing Plant.—The Mirrlees Watson Co., Ltd., have recently received orders for a number of condensing plants, among which are the following:—

A. Williams, Mexico.—Three sets of barometric condensing plants, 38,500 lb. steam per hour.

Clifton and Kersley Coal Co., Ltd.—Barometric condensing plant, 30,000 lb. of steam per hour.

Baldwins, Ltd., Port Talbot.—Surface condensing plant, 30,070 lb. of steam per hour.

Broken Hill, New South Wales.—Low level jet condensing plant, 10,000 lb. of steam per hour.

For Great Boulder Prop. Mines, Ltd.—Surface condensing plant, 21,100 lb. of steam per hour.

Chas. Walmsley & Co., Ltd., Bury.—Surface condensing plant, 15,600 lb. of steam per hour.

P. J. Mitchell, London, for Whitehaven Coal Co.—Surface condensing plant, 13,000 lb. of steam per hour (condenser only).

The Linde British Refrigeration Co., Ltd.—Surface condensing plant, 8,000 lb. of steam per hour.

Bolckow, Vaughan & Co., Ltd., Middlesbrough, for South Bank Turbo Plant.—Surface condensing plant, 43,000 lb. steam per hour, repeat order.

Okura & Co., London, for Formosa.—Barometric condensing plant, 36,250 lb. of steam per hour.

Dissolutions and Liquidations.—Thomas Parker, Ltd.—The creditors of this company must send particulars of their debts, &c., to Mr. W. A. Nelson, the liquidator, Lichgate, Wolverhampton, by August 28th.

General Electric Sign and Engineering Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. E Hayes, the liquidator, 28, Basinghall Street, E.C., by September 7th.

Sharpe & Waters, electrical engineers, 34, Uverdale Road, Chelsea.—Messrs. Enoch Sharpe and Alexander Waters have dissolved partnership. Mr. Sharpe attends to debts.

J. H. Holmes & Co., electrical engineers, Newcastle-on-Tyne, also W. H. Holmes & Sons, paint and colour merchants, &c., and the Castle Brand Co. (paints, varnishes, colour, &c.).—Messrs. A., J. H., Elwood and Leonard W. Holmes have dissolved partnership, Mr. L. W. Holmes retiring. The remaining partners will attend to debts.

Trade Announcements. — Messrs. Stewart and McDonald, 245, Buchanan Street, Glasgow, inform us that they have commenced business at the above address as electrical engineers, &c., and will be glad to receive catalogues and lists from manufacturers and merchants.

Mr. A. Whittaker, late with Whittaker's Arc Works, Rochdale, is about to open business as electrical engineer and X-ray and medical apparatus maker at 34, Princess Street, Barnsley, Yorkshire, and will be glad to have catalogues relating to all electrical work and tools.

Messrs. J. & H. Grevener, of Eldon Street House, E.C., are introducing special facilities for North of England customers, and are opening a branch at 40, Brazennose Street, Manchester, where special efforts are to be made to push the sale of their "Arco-flame" lamps, cables, watertight fittings, &c. Mr. H. J. Booker of their London office, has been deputed to organise and open up this branch in conjunction with Mr. A. Albrecht, of the Newcastle office. Ample stocks will be held at Manchester and Newcastle. Northern clients are asked to take a note of the address.

The "Omega" Electric Lamp Co., Ltd., have now moved into their new factory premises at Palace Works, Crab Tree Lane, Hammersmith, W., where they are carrying out orders for all voltages of the "Omega" metallic-filament lamps. A circular announcing prices of stock lamps has been received.

For Sale.—Certain electrical plant, a coal-cutter and other plant, &c., at Conyer's Colliery, Dewsbury Moor, Dewsbury, are to be offered for sale by auction by Mr. R. S. Balden. An announcement appears among our advertisements.

"Metalik" Lamps.—Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C., inform us that they are able to supply 25-c.p. high-voltage "Metalik" lamps.

LIGHTING and POWER NOTES.

Belfast.—Street lighting occupied the attention of the Police Committee last week, owing to the proposals of a special sub-committee which had made certain recommendations as to experimental electric lighting, and the discussion which took place illustrated the rivalry which frequently exists between gas and electricity committees. Councillor Doran said that gas was being supplied at cost price, and (he assumed) that electricity would be supplied under cost. He asked how could the Council expect the Gas Committee under such circumstances to go on giving £15,000 a year to the rates, if they allowed competition of this kind? The Police Committee is not satisfied with the gas lighting of certain thoroughfares, but apparently this does not matter, if only gas is the illuminant.

Bodmin.—At a meeting of the T.C. recently, the Council in committee reported having considered the application of Messrs. Meagor regarding a proposed electric lighting scheme for the town, and resolved that they be informed that the Council would be disposed to favourably entertain their proposals, provided they would submit details of a suitable scheme, and furnish an acceptable guarantee that they will be able to carry out a workable contract. The borough surveyor was authorised to confer with Messrs. Meagor, if they so desired.

Bradford.—The last year's operation (to March last) of the electricity undertaking showed a surplus of £2,142, as against £1,135 in the previous 12 months. Against this, however, had to be set £1,491 for adjustment of liabilities on March 31st, 1908, and a sum of £1,200, rebate to the tramways department in consequence of the failure to provide it with transforming sub-stations. The general supply showed a drop of £217 during the year, but this was more than compensated for by an increase of £4,064 in bulk supply.

Brazil.—The American Vice-Consul at Santos reports that there is a plan in the city of Joinville, the principal foreign trade centre of the Brazilian State of Santa Catharina, to build an electric railway to Lake Saguassu, an ocean harbour 10 miles distant, where vessels can enter successfully. At present Joinville freight is handled by barges *via* the port of San Francisco, but the irregular condition of the river has caused the plans for the new method.

Burslem.—The assessment of the Corporation Electricity Works has been reduced from £1,180 to £1,000.

Canada.—There is under construction at Cobalt an 11,000 H.P. power plant. The works are being carried out by the Mines Power, Ltd., on the Matabitchoun River, 24 miles south-east of Cobalt, at a point where the river has a fall of 300 ft. The generating equipment consists of four units of 1,500 KW. each, normal rating, and four turbines of 2,750 H.P. each at 600 R.P.M., also two Pelton driven exciters. The hydraulic plant is being supplied by Jens Orten-Boving, of London. The transmission is to static sub-stations at Cobalt, Kerr Lake, and South Lorsine, at 44,000 volts, and will be carried over two three-phase circuits on separate pole lines, over a right of way 135 ft. wide. The transmission cable will be of No. 00 aluminium supplied by the Northern Aluminium Co., of America. These works are to supply power to the mines of Cobalt, and are expected to be completed in the autumn.

A staff of Toronto engineers has been making extensive surveys for Simcoe Railway and Power Co. at Big Chute on the Severn River, 30 miles from Midland. It is expected that 4,000 H.P. can be developed and distributed.

The Nipisseng Power Co. is constructing a power plant on the South River, 19 miles from the town of North Bay, to supply that rapidly growing town with electric power. A 90 ft. head will be developed, giving about 1,000 H.P. The transmission will be at 22,000 volts.

The famous Healy Falls on the Trent Valley Canal will be developed by the Dominion Government by the construction of a dam on the canal; the water will be taken through the upper canal cutting and at the first lock discharged into pipes to the power house below. A head of 76 ft. will be developed and power supplied to several towns on the lake front.

According to the *Canadian Electrical News*, a consolidation of all the electrical development companies in and about the city of Quebec, is likely in the near future. The concern will be capitalised at $8,000,000.

Consett.—The Durham County Electric Power Co. has applied to the B. of T. for consent to erect an overhead low tension transmission line between the Co-operative Stores and the Theatre and Guardian Offices.

Continental Notes.—Norway.—In the report for 1908, which has just been published, of the Christiania Municipal Electrical Works, there are many interesting details showing what progress has been made in Christiania, which has a population of about 230,000. The balance-sheet shows a total income of 1,323,360 kr. (£74,000) as against 1,164,861 kr. (£64,600) for 1907. The expenses including 288,585 kr. (£16,000) for interest, new plant, and extensions, are 692,612 kr. (£38,500), which deducted from the income leaves a profit of 630,740 kr. (£35,000) or 216,898 kr. (£12,000) more than was estimated. The net profits amount to about 9 per cent. on the capital expended. In October the works increased their capacity by contracting for 2,000 kw. from a pulp manufactory in the neighbourhood; 36 large factories are being supplied from the works, apart from lighting and tramways. The maximum load on the direct-current system was 2,944 kw., and on the alternating system 1,950 kw., and 1,020 kw. on the tramways. Extensions of cables during the year amounted to 926 km. (5⅔ miles) for the d.c. system, and 39·57 km. (25 miles) for the alternating system. At the end of the year the total length of cables was 521·22 km. (316 miles). The number of sub-stations was 37, and in addition there were 16 kiosks. On December 31st last, 11,130 kw. was connected. The total capital spent on the whole plant at December 31st last was 7,034,071 kr. (£388,889).

A factory has recently been started at Salterod, near Arendöl, for the purpose of producing silicious iron by means of electricity. The raw material to be used is scrap iron. The name of the company is the General Electrometallurgical Co., with the head offices at Christiania.

Russia.—The municipal authorities of Koslov are considering a project for the establishment of a central electric lighting station in the town.

Sweden.—Last week-end the workmen at the Stockholm electricity works went out on strike, and as a result the city was without the electric light. The tramway service was also suspended.

Dublin.—The Corporation has agreed to a proposed loan of £18,650 for electrical purposes from the Royal Liver Friendly Society at the rate of £3 15s. per cent. per annum, repayment to be effected in 20 years.

Glasgow.—An arrangement has been come to between the T.C. and the Clyde Valley Electrical Power Co. for the laying of cables between Rutherglen and Cathcart. At a recent meeting of the T.C. Committee it was decided to give the company power, as requested, on condition that (1) the company undertook not to supply any energy off its mains within the city boundary, and (2) did not use the permission granted as an argument for getting authority to lay additional cables or to supply electrical energy within the city boundaries. Besides agreeing to the above conditions, the company has decided to remove its cables from the streets within the municipal area when required by the Corporation, and to pay a nominal rent of 10s. per annum to the T.C.

Govan.—From the report of the Electricity Department of the T.C., it appears that 2,877,979 units were generated and 2,356,867 units were sold up to the end of the financial year ending May 15th, as compared with 2,653,794 and 2,161,494 respectively last year. The total revenue was £16,072, and the total charges £15,544, leaving a net profit of £528. On the total charges an increase of £464 was shown, while the net profit decrease was £100, of which £78 was due to bad debts. The accounts were considered satisfactory in view of the prevalence of dull trade.

Halifax.—The T.C. has reduced the price of energy for the tramways to 1$\frac{1}{16}$d. per unit as from April 1st, 1908.

Hastings.—In order to comply with regulations of the Home Department, the T.C. has sanctioned the expenditure of £1,230 for new transformers at certain sub-stations.

Hull.—At the meeting of the Electric Light Committee some complaint was made that the Committee had been allowing a special discount to firms using electricity for motor purposes, and that firms were being supplied at less than cost price. Mr. Costello pointed out that an injustice was being done the users of electricity for lighting purposes. The chairman (Mr. Hanger) explained that the accounts for electricity for motor purposes were sent out monthly, and discount was allowed when the accounts were paid within 14 days.

Japan.—A hydro-electric scheme is being carried out by a Japanese syndicate, by which the water from Lake Biwa will be deflected through a series of tunnels and canals to a power house seven miles distant at Uji, some little way down the Uji River which forms the outfall of the lake. The Uji River Electric Co., Ltd., which is carrying out this scheme, has a franchise to take 2,000 cb. ft. of water per second, and with the head of 205 ft. which can be obtained, can develop some 40,000 h.p., and with further hydraulic works 60,000 h.p., which would be the largest power development in Japan. From Uji the company proposes to supply power to Kyoto, eight miles away, and to Osaka, 22 miles away, by means of aerial transmissions; it is also proposed to establish an auxiliary factory for the supply of electrical plant. The capital of the company is 12,500,000 yen; it is expected that the works will take some three or four years to complete.

Leigh.—A correspondent states that the Chairman and Vice-Chairman of the Electricity Committee are to confer with the Chairman and Deputy-Chairman of the Gas Committee and with two members of the Council, with respect to the working of the two departments.

Luton.—A L.G.B. inquiry was held on August 5th, relative to the application of the T.C. for a loan of £11,707 for electricity purposes. There was no opposition, but the inspector (Mr. H. R. Hooper) left open a question of £4,500 on the surplus account for future extensions, in order that he could see the finances and start clear on April 30th, 1909. Consequently the inquiry respecting this sum was adjourned *sine die*.

Middlesbrough.—Last week-end the experimental lighting of Corporation and Newport Roads by 20 Crompton arc lamps was commenced. The arcs will be in use until midnight, two incandescent lamps being substituted after that hour.

Newport (Mon.).—The T.C. has arranged to give a supply of power to Messrs. Guest, Keen & Nettlefold and to Messrs. King & Co. when the cables are laid; lighting mains will also be put in.

New South Wales.—The North Sydney Council has had under consideration an application from the Kirribilli Electric Lighting Co. for permission to erect pole lines with a view to supplying electricity in the locality. It was decided to defer the matter for a month, owing to opinions expressed in favour of municipal working.

Oulton Broad.—The U.D.C. has decided to invite tenders for working the electric lighting order.

Rosyth.—It has been decided by the contractors for the new naval dockyard works at Rosyth, on the Forth, to lay down plant to supply their own electrical power and light. For a time the idea was entertained of obtaining power from the Fife Electric Power Co. A large installation of electrical machinery is being arranged for. In addition to requiring power for the many electric cranes to be employed on the contract, there will be a great development of lighting, as much night work is on the contractor's programme.

Southampton.—At a recent meeting of the T.C., Mr. Street, the electrical engineer, submitted a long report in regard to free wiring. He said that the Southern Free Wiring Co., which had carried on work in the town, had, for reasons that had nothing to do with the Corporation, practically given up canvassing for new work, although, of course, the Corporation was still collecting the money due to it on account of existing contracts from sundry consumers. The method adopted was to charge 1d. per unit extra to all of the Free Wiring Co.'s consumers, which money was paid over to the company. He considered it much the best to leave the wiring work to the contractors, who had better facilities for doing it than the Corporation, as the class of men employed was quite different to that employed by the municipality. The whole of the necessary expenditure could be defrayed out of revenue or the reserve fund. Assuming that they invested £2,000 of their fund in free wiring, they could install about 2,600 lamps at a cost of 15s. per lamp, which was above the average cost of installation in Southampton. The revenue on this from sales of electricity at ordinary rates would be no less than £600, to which would be added the extra cost for free wiring, which, say, at 1d. per unit, would amount to not less than £200. With assisted wiring, the revenue would be greater. They had the support of all the principal wiring contractors of the town, who saw in the proposal a considerable increase of business coming to them. They would not hurt the builders who desired to wire houses as they were built, but would be of assistance to them. A large number of ratepayers also wanted the scheme. The Committee recommended the Council to obtain Parliamentary powers for the purpose suggested by the electrical engineer. An amendment referring the matter to the Parliamentary Committee was carried after discussion.

Stretford.—Eighteen street lamps are to be converted to electric incandescent lamps on the present columns at a charge of £1 per lamp. The charge for electric current to these and all similar existing lights is to be reduced from 45s. to 42s. 6d. per lamp per annum. At the expiration of 12 months the matter is to be reconsidered with a view to a further reduction, if possible, to 40s. per lamp. 1d. per unit is to be charged the Tramways Department for energy for three years, subject to adjustment according to the price of coal.

St. Helens.—The Corporation Electricity Committee has decided to supply electricity to Messrs. Bickford, Smith & Co., Ltd., subject to a three-years' guarantee and an annual consumption of £100, the company to provide a brick chamber for use as a sub-station. A similar supply is to be given to the Magnum Steel Co., Ltd., subject to an annual consumption of £300.

Wimbledon.—An electrical exhibition is to be held in the Baths Hall during 10 days in November next. Messrs. Babcock & Wilcox's chain-grate mechanical stokers are to be installed on two boilers at the generating station, at an estimated cost of £600.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Something of an unique description is to be ventured upon by the Corporation in connection with tramway fares. For the first time in Scotland the T.C. at their recent meeting decided to introduce a system of universal penny fares from the centre of the city to the various termini of the different routes, while the halfpenny fares are, with one exception, to be abolished—the exception being in Union Street—the principal thoroughfare in the city. This decision was arrived at after consideration of the annual report of the Tramways Committee. Mr. John Coutts, who submitted accounts, pointed out that the revenue from passenger traffic was £70,325, against £70,754 in the preceding year, a decrease of £429. The total working expenses amounted to £40,794, against £38,666 last year—an increase of £1,525. The cost of electricity for power increased from £8,971 last year to £9,564, explained by the fact that, while the rebate on the amount paid to the electricity department last year amounted to £741, the rebate this year was only £90—a reduction of £651. The balance of revenue after deducting working expenses amounted to £31,485 as compared with £33,261 last year, a decrease of £1,776. The total capital expenditure of the undertaking now stood at £318,593, and the mortgage loan debt amounted to £260,853 at May 31st last. Although they had been able to put by a very substantial sum to reserve account, that account was not yet so high as it ought to be, because very heavy calls would be made on it almost immediately. He therefore thought the Corporation should pursue a policy of caution and not make any alteration on the present fares which would jeopardise their present position.

Canada.—Canadian engineers are considering the electrification of the Grand Trunk Pacific Railway from the St. Lawrence River to Monckton—460 miles—the electricity to be developed by harnessing the Grand Falls on the St. John River.

Chesterfield.—The annual report on the tramways undertaking for the year 1908-9, shows a net balance on the working of £600, as compared with £978 in the previous year; the surplus was added to the reserve fund, which now amounts to £3,627. Some 2,481,321 passengers were carried, and 293,380 car-miles run during the year, the results of which, considering the limitations of the system, undoubtedly reflect credit on the manager, Mr. Acland.

Continental Notes. — GERMANY. — The municipal authorities of Spandau (Brandenburg) have just acquired the electric tramways in the town from the Allgemeine Electricitäts Ges., of Berlin, for the sum of £175,000.

Eccles.—The Corporation has joined the Salford Corporation in an action against the South Lancashire Tramways Co.

Ecuador.—According to the terms of a draft contract recently published, Mr. Julio H. Cardon is empowered to arrange for the construction of a 3-ft. 6-in. gauge electric railway from Babahoyo, capital of the province of Los Rios, to Balzapamba, in the province of Bolivar, with further powers to extend the line to Guaranda, capital of the province of Bolivar. The cost of construction is estimated at 1,380,000 American gold dollars (about £287,000), which amount will be guaranteed by the Government of Ecuador. The concessionaire will have the right to work the railway on certain terms for a period of 50 years.—*Board of Trade Journal.*

Elland.—The U.D.C. has decided to call upon the West Yorkshire Tramway Co. to carry out its undertaking to extend the tramways between Elland and West Vale, which, under the Act, should have been opened in July.

Fife.—After a delay of some years, the work in connection with the laying of the line of tramways to connect Lochgelly and Cowdenbeath with Dunfermline has been begun. The contract for the supply of the current has been secured by the Fife Electric Power Co., which is constructing an aerial transmission from its station at Townhill, Dunfermline, to Cowdenbeath. The company has also an order for additional dynamos of the latest type for the purpose of coping with the load which the tramways will impose. A shed is being constructed at Cowdenbeath to accommodate 30 cars.

Glasgow.—The plan adopted by the Tramway Department of placing boxes at the ends of the cars as a depository for used tickets, in order to keep the cars and streets tidy, has met with such success that their accommodation is quite insufficient, and it is now proposed to place an extra box at each end of the car. Many tons of tickets are collected every month, and these are disposed of at a profit by the cleaning department. Mr. Dalrymple, the manager, is receiving inquiries from other large centres as to the system; London, Birmingham, Manchester and other cities being anxious to solve the problem of keeping the cars tidy.

Hull.—Reports have been prepared for the Corporation in connection with the proposal to extend the Corporation electric car service to Hessle, a further stretch of five miles.

Isle of Man.—A Ramsey man, named Knight, was killed on the Manx Electric Railway on Tuesday. He was employed as conductor on the electric cars, and whilst crossing from the trailer to the closed car as the train was in motion, he fell between them. The wheels went over his body and inflicted fatal injuries to the head and lower limbs. He died in 15 minutes without gaining consciousness.

Japan.—Mail intelligence from the United States says that the Department of Communication in Japan, under which the railroads are operated, is considering a plan for electrifying the railways of the island empire. The Japanese Government recently appointed a special commissioner to investigate electrical railways in England, Europe and the United States, and he is now about to make his report. In an interview the Commissioner said that it would only be a short time before all the branch lines were operated by electricity, for the sake of economy.

Leith.—An inspection of the new portion of the Council's tramways between Bonnington Terrace and Goldenacre took place on the 3rd inst., the members of the Council and officials subsequently proceeding over the whole of the extension to Granton and Newhaven. According to some remarks made by Bailie Hall, the portion of the new route open has yielded receipts of 10·07d. per mile, as compared with 7d. per mile on the original system, and great things are expected of it.

L. and Y. Electrical Lines.—Presiding at the general meeting of the Lancashire and Yorkshire Railway Co. on Wednesday, last week, the Chairman, Sir Geo. Armytage, said that though the total number of passengers carried showed a decrease, he was glad to say that residential traffic was still on the increase, and especially on the electrified lines between Liverpool and Southport. They had decided to extend the electrification from Aintree to Maghull, and that work was now in progress.

Musselburgh.—The eastward extension of the Musselburgh Electric Light and Traction Co.'s line, from Levenhall to Cockenzie, was inspected by the B. of T. last week and opened for traffic. The line will ultimately end at Port Seaton; at present it gives a continuous route, 11 miles long, with one change, from Edinburgh. After the official inspection by Col. von Donop, the directors of the company entertained the representatives of the local authorities on the route to luncheon at the Prestonpans Town Hall.

Newcastle-on-Tyne.—At a meeting of the T.C. on the 4th inst., the annual financial statement of the Corporation tramways undertaking was submitted and adopted without discussion or comment. This, says our Newcastle correspondent, is somewhat surprising, as a warm debate was anticipated on the old question of depreciation. The statement of accounts could not be regarded as strikingly satisfactory, for the absolute net gain on the year on an undertaking which has a capital expenditure of about one and a quarter millions, was £377. It is a fact that the reserve and renewals fund account shows an appropriation for that purpose of £7,557 from the profits of the year, but the same account shows also an expenditure for the year ended March 31st, 1909, of £7,181. The items of expenditure on the renewals account were: Batteries, £2,844; switchboard, £512; pumping plant, £2,989; permanent way, £834. The reserve fund balance is now £62,699 as against £62,323 for the preceding year. For the year the gross revenue had dropped from £211,318 or 11·50d. per car-mile for 1908, to £204,123 or 11·42d. per car-mile, for 1909. The total working expenditure had increased from £116,852 = 6·36d. per car-mile, to £122,609 or 6·86d. per car-mile. The balance carried to net revenue account was £81,513 or 4·56d. per car-mile, against £94,466 or 5·14d. per car-mile for the preceding 12 months. The net profits decreased from £19,477 or 1·06d. per car-mile, to £7,557 or ·423d. per car-mile, and this latter sum has been in effect reduced to the £377 mentioned, because the system has not been maintained (as it is claimed has hitherto been, and would be, the case) out of revenue, but replacements paid for out of the reserve fund.

Plymouth.—The tramways manager has submitted the following return to the Tramways Committee of the T.C. for the year ending March 31st, 1909. The gross income was £34,150, against £32,931 for the year ending March 31st, 1908. The expenditure was £26,084, leaving a gross profit of £8,065, against £8,424 last year. On the net revenue account there was an income of £9,323, of which £4,785 went to dividends and interest, and £4,429 to stock and mortgages redemption, leaving a net profit of £108, against £815 in 1908.

Radcliffe.—The Electricity and Tramways Committee of the local D.C. is about to adopt a scheme for the carriage of goods from the railway station to the local mills and works through the medium of the tramway service.

Sheffield.—The municipal tramways undertaking made a net profit of £36,635 during the year 1908-9, of which sum, £15,000 was devoted to the rates.

Southend-on-Sea.—The T.C. has been granted a revival of powers for extending the tramways to Shoeburyness.

Walsall.—The local Tramway Committee has reported adversely against the project for linking together the various mining villages of Brown Hills, Chase Town, Chase Terrace, Five Ways, Cannock, Wyeley and Newtown. The scheme, if carried out in its entirety, would cost £168,000, or about £12,000 per mile.

Wigan.—Mr. James Slevin, the engineer and manager of the tramways undertaking, has been experimenting with a sprinkler, locally made, for disinfecting the inside of tramcars. The results have been very satisfactory. The disinfectant used dries immediately, and all germs are destroyed. Mr. Slevin is to report later upon the cost.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Government of the Commonwealth state that their cables to Tasmania are laid from Flinders, Victoria, to Low Head, Tasmania, and the lengths are respectively 346,783 and 344 229 km. These are the two cables replacing those of the Eastern Extension, Australasia and China Telegraph Co., which are to be picked up.

Australian Telephone Service.—The telephone question has reached an acute phase in Australia, where protest meetings such as were common in this country last year have been held, and the Government has decided to defer the introduction of the new tariff for a time, pending an actuarial inquiry by a committee of accountants as to the actual cost of the service. An inquiry has been instituted into the conditions of work at the exchanges, in which many complaints have been put forward on the part of the employés on the score of overwork, too little pay, petty tyranny, and so on. Defective equipment and organisation formed the substance of many complaints, and if all the evidence given by the staff were accepted without qualification, the conclusion that the telephone system was in a chaotic state would be inevitable.

Jamaica.—For the financial year 1907-8 the revenue from telegraphs was £6,489 8s. 8d., against an estimate of £6,000; £832 was spent on the maintenance of telegraph lines. The cost of official telegrams was £414 4s.

London—Berlin.—It is stated that preliminary negotiations are proceeding between the interested Governments with a view to the establishment of a direct telephonic connection between London and Berlin. An inquiry on the subject, made by the representative of a Berlin newspaper at the Imperial Post Office in that city, elicited the statement that apart from the large expenditure which such a scheme would involve, the question at issue was very difficult, as technical progress had not yet so far advanced as to permit of the construction and laying of submarine cables for telephone working of such lengths as would be necessary in this particular case. Another question was whether it would be possible to secure the object in view in a roundabout way by inducing a third country to become interested in the scheme, so that permission might be obtained to erect an overland line to the English Channel and thence to London.

New Regulations.—The General Post Office has issued notices to merchants, stating that since the 1st ult. the new regulations passed by the Lisbon Telegraph Conference are in force. According to these, artificial words or groups of letters or trade marks must not contain the accented letters ä, á, à, é, ñ, ö, ü, and in code words or trade marks se, as, ao, oe, ue will be counted as two letters each. In artificial code words or trade marks "ch" will count as two letters.

Codes can be submitted to the British, German and French Administrations for approval, and owners may obtain a certificate of approval after this has been done. Cipher composed of letters and figures is not admitted, nor are combinations or alterations of proper words.

Telegraphic Interruptions:—

Tangier-Cadiz	May 19, 1909
Assab-Perim	July 8, 1909
Trinidad-Demerara	August 6, 1909
Dakar-Conakry	August 6, 1909
Gibraltar-Tangier	August 6, 1909
Ceuta-Tangier	August 7, 1909
Melilla-Chafarinas	August 7, 1909

Windsor Castle.—A complete new installation of fire-alarms has recently been installed at the Castle. There are 35 alarm boxes, and when any one of these is operated, a distinctive number is sounded on a gong in the residence of each member of the fire brigade.

Wireless Telegraphy.—The Inter-Ministerial Commission on Wireless Telegraphy has drawn up a Bill prohibiting the employment of any radio-telegraphic apparatus on French territory, or on board of any French vessel, without State authorisation. Heavy fines are to be imposed in the case of persons who have caught and divulged radio-telegraphic or radio-telephonic messages.

The *Times* reports that the Russian Military Department has made some very successful trials with wireless telegraphy between St. Petersburg and Sebastopol, a distance of about 1,900 miles.

The Halifax (N.S.) *Herald* states that Sable Island is no longer feared by ships, owing to wireless telegraphy, by means of which they are warned of their proximity to its dangerous coast. During the past year Sable Island had to its credit the largest number of wireless messages handled during the year, viz., 8,118 private and 5 000 official communications. Not a single wreck occurred near the island after wireless was installed. The Canadian Government's marine signal service is being very much extended. There are over 20 wireless stations in Canada, of which five are situated on the Pacific Coast. The latter will shortly be increased by two or three, the superintendent of the Government wireless stations having recently left for British Columbia with a view of installing new stations. During 1908 there were received and sent from the wireless stations 13,549 private messages from and to steamers, 13,526 signal service messages, and 38,532 messages between Government steamers and light stations.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Ten 100-number switchboards for the Postmaster-General's department in New South Wales. See "Official Notices" July 16th.

New South Wales.—Telephone material for the P.M.G. See "Official Notices" July 23rd.

Ballinasloe. — September 10th. The Committee of Management of the Ballinasloe District Lunatic Asylum wants tenders for the supply and erection of overhead cables. See "Official Notices" July 30th.

Belgium.—September 1st. Tenders are being invited by the municipal authorities of Ixelles, a suburb of Brussels, for the concession for the electric lighting of the district.

Cleckheaton.—The U.D.C. wants tenders for the purchase of two battery regulating switches. See "Official Notices" July 30th.

Edinburgh.—September 4th. The Corporation invites tenders for a motor-alternator and for an electric lighting installation. See "Official Notices" August 6th.

September 4th. Electric light installation at the new slaughter-houses, Gorgie, for the Corporation. Specification (one guinea deposit) from Mr. F. A. Newington, electricity supply works, Dewar Place.

France.—Paris.—August 18th. The Under-Secretary for Posts and Telegraphs, 103, Rue de Grenelle, Paris, requires tenders for 75 stamping machines worked by electric motors.

Leeds.—September 7th. Paper-insulated cables for the E.L. Department. See "Official Notices" to-day.

Leyton.—September 7th. Public lighting lanterns with clock switches for incandescent electric lamps, for the U.D.C. See "Official Notices" to-day.

London.—Battersea.—August 21st. The Council wants tenders for motors and controllers, D.C. flame and enclosed arc lamps, and motor and arc lamp installations. See "Official Notices" August 6th.

L.C.C.—September 14th. The L.C.C. wants tenders for the supply and laying of 6¼ miles of 0·075 sq. in. three-core cable and 46 miles of single-core cable, telephone cables, &c.; the supply of 50 tramway feeder pillars; laying 16 miles of stoneware ducts; and the supply of 440,000 stoneware ducts. See "Official Notices" August 6th.

Poplar.—September 8th. Electrical supplies for a year for the B.G. G. H. Lough, Clerk, 45, Upper North Street, Poplar, E.

Plymouth.—September 2nd. Steam turbo-dynamo for the Corporation. See "Official Notices" to-day.

Rhyl.—August 21st. The U.D.C. invites tenders for a 125-kw. Diesel set and a 50-kw. steam dynamo. See "Official Notices" August 6th.

Russia.—September 13th. The municipal authorities of Bachmouth (Government of Ekaterinoslav) are inviting tenders for the concession for the public electric lighting of the town.

Todmorden.—August 14th. The Corporation wants tenders for a 150-kw. steam dynamo, switchboard, condensers and piping, and pump. See "Official Notices" August 6th.

Turkey.—The Ministry of Marine, in Constantinople, invites tenders for the supply of electrical apparatus for the Imperial fleet. Inquiries should be addressed to the Conseil de la Marine, Constantinople.—*B. of T. Journal.*

Wishaw.—August 30th. Three-wire D.C. switchboard for the Craigneuk sub-station for the Electricity Department. See "Official Notices" to-day.

York.—August 27th. The Corporation wants tenders for 18 double-deck electric tramcars and a watering car. See "Official Notices" July 30th.

CLOSED.

Barnstaple.—The B.G. received the following tenders for wiring the workhouse for the electric light:—

Mr. Malone, Barnstaple	(accepted)	£122
Mr. Rippin, Exeter		130
Baker & Co., Newport		130
Bristol Electricity Co.		135
Harris & Co., Exeter		141
Messrs. Edmonds, London		186
Messrs. Pullen, Bradford		191

Belfast.—The Electrical Committee has accepted the tender of Messrs. Cowans, Ltd., for feeder panels for the lighting switchboard.

Bury (Lancs.).—The T.C. has accepted the tender of Messrs. Clarke, Chapman & Co., of Gateshead, for three water-tube boilers, with superheaters and mechanical stokers, for the new power station.

Canada.—Messrs. Jens Orten-Böving & Co. have just received the order for two water turbines (output 3,750 H.P. each) for the Calgary Electric Power Co., Calgary, Canada. The same firm have also received the order for four "Böving Patent" governors for four Francis turbines of 2,750 H.P. each for the Mines Power, Ltd. The consulting engineers in both cases were Messrs. Smith, Kerry & Chace, of Toronto, Winnipeg.

China.—It is reported that the contract for the establishment of a telephone service in Pekin has been awarded to the Western Electric Co., the amount of whose tender was $150,000.

SHANGHAI.—The Chloride Electrical Storage Co., Ltd., has secured an order for a 550-volt battery and an Entz booster, capable of handling 2,000-amp. peaks.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for distributor cables, troughing, service cable and bitumen.

Clyde Navigation.—Tenders for 46 electric capstans for Yorkhill and Rothesay Docks, Glasgow, have been received by the Clyde Navigation Trust.

Darlington.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., for a switchboard for the new turbo-generator; and that of the Whessoe Foundry Co. for pipe work.

Denmark.—The contract for the supply of copper wire for the new municipal electrical works of Bergen has been given to the Westphaelische-Kupfer & Messingwerke, in Germany. The contract in question amounts to 240,000 metres of wire, at a total cost of 90,000 kr. (£5,000).

Dundee.—The "D.P." Battery Co., Ltd., of Bakewell, have received an order for a storage battery of 50 cells for Dundee University College from Messrs. Steinthal & Boydell, Ltd., of Manchester and Bradford, who are supplying the whole of the electrical equipment of the college.

Dunfermline.—Messrs. John Munro & Co., Edinburgh, have secured the contract for the electric lighting of Dunfermline Technical School extension, at £258.

France.—La Société de la Canalisation Electrique, of Saint Maurice (Seine), has just secured a contract from the French Posts and Telegraphs authorities for the supply of 200 kilometres of telephone cable.

Glasgow.—The Tramways Committee has recommended for acceptance the tender of the British Thomson-Houston Co., Ltd., for controller arc shields.

Halifax.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for cables, at £2,104.

Hastings.—The Corporation has accepted the tender of Messrs. W. Cory & Son, Ltd., for the supply of 1,500 tons of the best Welsh smokeless coal for the electric light works, at 23s. 9d. per ton. The coal specified is Nixon's Navigation large coal. For the supply of 1,350 tons of coke, the tender of the Hastings Gas Co. has been accepted, at 17s. 6d. per ton.

London.—SHOREDITCH.—The B.C. has accepted Mr. William Boby's tender for a water-softening plant for use at the electricity works.

Maidenhead.—The T.C. has accepted the tender of the Diesel Engine Co., Ltd., for a 150-KW. Diesel engine and generator, at £2 504 16s. Messrs. Mirlees, Bickerton & Day tendered at £3,038.

Maidstone.—Regarding the note under this heading in our last issue, the Union Electric Co., Ltd., inform us that they did not tender for any feeder or other cables for Maidstone.

Salford.—The T.C. has accepted the following tenders for the annual supply of coal for the electricity works:—

Clifton and Kersley Coal Co., Ltd.—20,000 tons washed slack, in boxes, in boats, 8s. 11d. per ton.
A. Knowles & Sons, Ltd.—12,000 tons washed slack, in boxes, in boats, 9s. per ton.

Stretford.—The U.D.C. has accepted the following tenders:—

W. T. Glover & Co., Ltd.—744½ yards of 0·2 cable, 9s. 8½d. per yard.
Beecroft & Wightman.—600 yards troughing, 8½d. per yard.
Callender's Cable and Construction Co., Ltd.—800 yards of ·05 cable, £28.

Tunbridge Wells.—The T.C. has accepted the tender of Henley's Telegraph Works Co., Ltd., for cables.

Wallasey.—The U.D.C. has accepted the tender of the Premier Accumulator Co., Ltd., for a battery of 264 cells, booster plant, and maintenance for 10 years.

Wolverhampton.—The Corporation has accepted the following tenders for the electricity department:—

Mobberley & Bailey, Stourbridge, £128, fire bricks for lining the steel chimney.
C. W. Hartley, Sheffield, £110, labour, tools, and tackle in connection therewith.
Electric Construction Co., Ltd., one 100-KW. reducer set, at £208 10s. and two low-tension switchboard panels, at £86.

NOTES.

Municipal Electrical Contracting: Proposed Test Case.—From the current issue of the *Electrical Contractor* we gather that the Secretary of the Electrical Contractors' Association has issued a letter to members asking for guarantee of support in the event of failure of the test case it has been decided to fight to test the legality of municipal electrical contracting upon isolated installations without special Parliamentary authority. In announcing this fact our contemporary says:—"Particulars of innumerable cases have been received, some of the most flagrant character, and Counsel has advised the Law and Parliamentary Committee that corporations have no such powers, and that an action would be likely to be successful. A test case decided in favour of the contractor would act as precedent in other instances, and a growing abuse, which is making vast inroads into the contractors' turnover, would be thus removed. Nevertheless, the possibility of failure must not be overlooked, and as any corporation we fight will have ample funds from the ratepayers' purse at disposal, it is only reasonable to assume that in the event of an adverse judgment the costs will be heavy. The member whom we nominate to fight the test case would of course be personally responsible for the costs of the other side if the case went against him, and it is this event, and this only, that members are asked to guarantee provision for. Mr. Tate has already circulated suitable forms to be filled in, but in case there is any member who has not received one we enclose a copy with this number of the *Electrical Contractor*. You are asked to guarantee any sum from £1 upwards. The amount of £3 has been suggested, because if each member guarantees this amount it is considered that sufficient provision will have been made."

Copper.—A writer in the *Financial Times* for July 30th, in the course of an interesting article on the copper outlook, attributes the continued maintenance of prices to the influence of the large copper interests. He takes the average prices of copper, noting that in 1908 the average price was £60 0s. 6d. per ton, compared with £86 1s. 8d. in the previous year and £86 5s. 2d. in 1906; while in 1905 it was £69 2s. 6d., and, for the three years previous, in the "fifties." Working to the average for the last 40 years, excluding sensational movements due to artificial causes, he arrives at the conclusion that the normal value is between £60 and £70 per ton. Passing to production, the author considers the huge stocks, both here and in America, to be the direct results of over-production. This, of course, is a natural outcome of extra high prices. The immediate course of values, says the author, depends—outside of manipulation pure and simple—upon the consumption. From statistics of the United States Copper Producers' Association, he finds that deliveries for consumption and import are steadily increasing. According to the Association's statistics, also, the stocks are unmistakably on the down grade. These, however, when analysed, do not appear to take into account that stocks in Europe are steadily accumulating. Considering, then, that copper can be produced at £37 to £38 per ton, the author inclines to the view that the manufacturer is content to work at his full output, taking his profit on quantity. In conclusion, the author does not anticipate a rapid improvement in the engineering and shipbuilding trades, and points out that every £1 added to the price of copper stimulates the output, and ultimately reopens mines at present shut down on account of too expensive winning.

Electrical Trades Union.—A meeting of the electrical workers of Liverpool and district was held on Friday evening in the Common Hall, Hackins Hey, when an address was delivered by Mr. Robert Ferguson (organiser of the Electrical Trades Union), in which he described the present position of the union, and urged non-members to join it. A resolution was passed strongly condemning the so-called workmen's registration scheme of the Electrical Contractors' Association, and urging all electrical workers of Liverpool and district to become members of their own Trades Union, in order that it may be strengthened sufficiently to protect their interests and better the conditions of labour in the future.

Inquiries.—A correspondent wishes to hear from British firms who specialise in electric head-lights and in electric carriage lighting for use on steam-driven trams.

Cable Dispute.—According to the daily Press, the Commercial Cable Co. alleges that the Newfoundland Government has committed a breach of faith, by repudiating a contract made a few months ago, on the strength of which the American company invested £200,000 in the landing of a new cable at St. John's. The company has addressed a strongly worded letter of remonstrance to the Premier of Newfoundland.

Terrestrial Magnetism.—The magnetic survey yacht *Carnegie*, which has been built almost wholly without the use of iron, and has a displacement of 568 tons, will be engaged in making a magnetic survey of the oceans during the next 15 years, with the object of correcting the magnetic charts at present available. According to *Nature*, her first voyage will be to Hudson Bay and the North Atlantic Ocean.

Electric Pumping for Irrigation.—The water for the great system of canals and ditches of the Mercedes, Tex., irrigation system is pumped from the Rio Grande by means of electrical energy which is supplied from a central power plant situated in the town of Mercedes, seven miles from the pumping station. The Mercedes enterprise will be one of the largest electrical pumping irrigation propositions in the world when the plans are fully rounded out. Water will be supplied for more than 200,000 acres of land, situated in the valley of the lower Rio Grande. The central power plant at present generates at 6,600 volts, the three-phase currents being transmitted to the pumping station, situated upon the bank of the river, seven miles distant, and operating an induction motor-driven pump, which has a capacity of 60,000 gallons per minute. The equipment of the central power plant consists of two generators of 300 KW. each, and a 15-KW. lighting set for the town of Mercedes, when the main set is shut down. The main canal of this system is already completed for many miles across the valley land, and carries a stream of water 145 ft. wide and 10 ft. deep. The canal is capable of being navigated by barges and boats. There are a number of other small electric pumping plants along the upper course of the Rio Grande River, particularly in the vicinity of Laredo, where a number of farmers receive electrical energy for operating their respective pumping stations from the electric power plant in the town.—*Electrical World.*

Producer Gas.—The principal constituent of producer gas being carbonic oxide, which is a very actively poisonous gas, it is necessary that its use be accompanied with special precautions. Death has been caused of men in a cabin by gas that had found its way there through the earth; thus it is desirable that a gas producer plant should stand upon a sound and practically air-tight floor, and it is preferable that the plant should be covered by a roof only, and that it should not be shut in by side walls, though there may be roller shutters as a wind guard on the more exposed side of the house.

The producers may very well be placed under a lean-to roof outside the engine house. If a gas producer is to be housed inside a building, and especially if it is placed in a cellar, there ought to be an open chimney to serve as a ventilator, and a very direct air inlet from outside. The warmth of the producer will suffice to keep the chimney at work. Unless out of doors, the escape pipe for use when blowing up the producer on starting the fire, for example, should open to a chimney. Very small percentages of carbon monoxide in the air will produce frontal headache and sickness; long-continued breathing of extremely small amounts produces anæmia, for the gas absorbs oxygen from the hæmoglobin of the blood, changing or destroying the red corpuscles. Complete insensibility is produced by inhaling the gas in bulk. A single inhalation is sufficient, but recovery would be rapid.

The curious fact about hæmoglobin is that its combination with CO is more stable than is its combination with oxygen. Thus CO will oust the oxygen, and the hæmoglobin is then incapable of carrying oxygen to the tissues. Haldane says that when the percentage of CO in air is 0·08, the hæmoglobin will ultimately become half saturated with the gas. With 0·04 per cent., saturation will be one-third only, while with 0·16 per cent. the saturation will be two-thirds. So long as saturation is not complete, recovery is possible, and the removal of the victim into pure air before death enables the CO to be gradually eradicated, especially with the aid of oxygen and artificial respiration.

The presence of CO is not apparent to the senses. A man may go a long way in a mine where it is present, and be unable to get back again. Fortunately, carbon monoxide is of less specific gravity than air, and does not introduce the further danger of accumulating in sunken places, as carbon dioxide does. Small animals such as mice, and also small birds, are particularly susceptible to carbonic oxide poisoning. If they thrive in a room containing a producer, this will be good evidence that there is no serious leakage in progress.

In our climate there is no reason for a producer plant to be housed in from the cold, though when a plant is at rest any water vessels should be drained, and water supplies should be arranged to be shut off by taps in a protected situation. These remarks apply particularly to gas engine jackets, which should be drained even for short stoppages in frosty weather. In some localities it may be found necessary to provide means for warming up the cooling tanks sufficiently to provide a flow to the jackets. Once the circulation is secured, and the engine is running, the complete thawing out will be completed without further heat than that from the jackets.

Appointments Vacant.—Shift engineer for Lanark County Council (Cambuslang). Practical instructor in electric light wiring and cable jointing for the Northampton Polytechnic Institute.

The Influence of Silicon on the Electric and Magnetic Properties of Iron.—Dr. E. Kolben has recently carried out an important series of experiments on silicon and its effects on iron, and we take the following particulars of these from *Elektrische Kraftbetriebe und Bahnen* for July 8th. Pure silicon was found to have a specific resistance varying between ·043 and ·08 ohm per cm. or 430 to 800 ohms for 1 metre length of 1 sq. mm. section, the corresponding values for copper being ·017 ohm, for iron ·11 ohm, for arc lamp carbons 70 ohms, and for ordinary carbon 100 to 800 ohms. The temperature coefficient of silicon is extremely low, being between — ·0002 and + ·00006 for 1° C., whilst for carbon it varies between — ·0008 and + ·0003. As regards magnetic and thermo-electric effects, silicon also stands somewhat by itself:—

Material.	Hall effect coefficient.	Thermo-electric E.M.F. against lead.
Silicon, 99 %	— 120	—
Silicon, 95 %	— 28	— 400
Copper	— ·0005	+ 3·8
Iron	+ ·011	+ 17
Tellurium	+ 532	+ 502

When iron is alloyed with silicon its effect on the specific resistance does not increase indefinitely with the percentage, but reaches a maximum with about 4 per cent. of silicon. The following results were obtained from a series of alloys made by the Bismarckhütte, the samples tested being in the form of ·5 mm. sheets:—

Reference letter ...	A	B	C	D	F
Per cent. of silicon—					
minimum	·026	1·07	2·28	—	3·5
maximum	·3	1·54	3·15	3·25	3·53
Specific resistance (ohm)	·118	·287	·355	·50	·595
Per cent. increase in resistance for 100° C. temperature rise ...	41	19	14	7·5	5
Tensile strength with the minimum per cent. of silicon ...	30·8	35·1	47·3	—	61
Elongation	11	7·5	6	—	3·5
Steinmetz hysteresis coefficient η... ...	·0015	·0014	·001	·0009	·0009
Hysteresis loss per kg. of iron	2·5	2·2	1·65	1·45	1·45
Eddy-current loss per kg.	1·3	·8	·7	·6	·4
Total iron loss per kg.	3·8	3	2·35	2·05	1·85
Flux density produced by a magnetising force H = 140	17,600	17,300	17,000 per sq. cm.	16,700	16,400

It will be seen that the tensile strength is increased by moderate additions of silicon, whilst the elongation diminishes. The material was, however, found to be very variable, probably owing to slight differences in manufacture. Experiment has repeatedly shown that chemical additions to iron, such as the silicon in this case, do not greatly affect the hysteresis loss, but have a marked effect on the eddy-current loss. Thus, whilst the hysteresis coefficient a few years ago was normally about ·0025, the highest value now considered permissible is about ·0015. The eddy-current loss, however, is reduced to less than one-third of the older value. The alloys with the higher percentages of silicon are especially suitable for transformers, but are somewhat too brittle for use in the rotating parts of high-speed armatures. Such samples as B or C, however, are quite suitable for the latter purpose. The ageing difficulty is entirely absent with an addition of as much as 3·5% of silicon.

Early Central-Station Practice.—In an interesting address recently delivered at the first annual convention of the Brooklyn Company N.E.L.A. Section, Mr. Caryl D. Haskins recalled some experiences of 21 years ago, when he was on the staff of the London Grosvenor Gallery central station. The station had no heavy-current ammeters, and the deficiency was supplied as follows:—A slot-like trough was cut in a block of wood, and terminals attached at either end of the slot, with a body of mercury connecting the terminals. This crude apparatus was calibrated against a Kelvin balance, using an ordinary glass-bulb thermometer immersed in the mercury, and in routine use the current passing through the "instrument" was determined by a reading of the thermometer. In the same plant knife-blade switches were used to handle the 2,200-volt circuits, and for use in switching there were provided pieces of 2-in. belting about 2 ft. long, each with a wooden handle. The rule was to take the switch firmly in the right hand and the piece of belting firmly in the other, pull out the switch, and then "swat" the arc with the belting. Referring to early power service in this country, Mr. Haskins quoted the following rule established by a central station for testing recording meters on power service:—"Examine the installation. Estimate the work being done by the motor in horse-powers. Multiply by 746. Test the meter by the customary formula. If meter checks within 10 per cent., correct. If not, estimate the horse-power again."—*Electrical World.*

A "Non-Electrical" Fatality.—In the case of a lamp-trimmer employed by the Battersea Borough Council, named Ernest Leonard, aged 36, who was supposed to have been killed by an electric shock, the Coroner's jury on August 10th returned a verdict of "Death from natural causes," the man having died of heart disease.

An Open Letter.—Dear Mr. Zadkiel,—

In the issue of *Electrical Industries* for the 4th inst., you state that the ELECTRICAL REVIEW in making a commentary on the chairman's speech at a recent annual general meeting, says: "Much might be written of what the trade thinks of the Press. . . . . " *Facetiæ!* We assert that we made no such remark in the article to which you refer, therefore the point is narrowed down to one of veracity.

It seems to afford a fellow a heap of satisfaction to pull the trigger for himself and see if the shooting iron is loaded, and a lesson learned at the muzzle has the virtue of never being forgotten

Parliamentary.—TORQUAY TRAMWAYS.—On Friday last week the Bill promoted by the Torquay Tramways Co. passed the Unopposed Bills Committee of the House of Commons. The measure provides for an extension of the company's tramways from Torquay to Paignton.

The Neasden Turbines.—Just as we are going to press with the last pages a letter arrives from Mr. Newcomb Carlton, managing director of the British Westinghouse Electric and Manufacturing Co., Ltd., in which he asks us to correct an alleged inaccuracy in our report of the half-yearly meeting of the Metropolitan Railway Co. (ELEC. REV., August 6th, p. 226). He writes:—

"You say:—Replying to a shareholder, the chairman said . . . . considering the fact that the British Westinghouse Co. were putting down fresh turbines for them *at their own expense*, &c. There is no doubt that Sir Charles M'Laren did not make use of the words in italics, since the statement is the direct contrary of the fact. Will you kindly publish this letter by way of correction."

Unfortunately our representative who attended the meeting is away on holidays, and it is impossible to confer with him in the few moments remaining before the REVIEW must be on the printing machine. In his absence the shorthand notes are also inaccessible.

Junior Institution of Engineers.—The summer meeting of the Junior Institution of Engineers opens to-morrow morning at Leamington, with a welcome by the Mayor; in the afternoon Warwick Castle is to be visited, and in the evening there will be a concert in the Jephson Gardens. Numerous works in the neighbourhood are to be visited, as well as at Birmingham and Coventry, during the week. The Institution's summer dinner takes place on Friday evening at Birmingham, and on the following morning the Summer Lane electricity works of the Birmingham Corporation will be seen, the afternoon being occupied with a visit to the electrical signalling apparatus of the Great Western Railway at Snow Hill Station.

A Japanese Deal at Seoul.—It is reported from Seoul that the American firm of Collbran & Bostwick, who own gold and copper mines in the north of Corea, and a bank in Seoul, have sold to the Japanese Gas Co. the Seoul electric tramways and lighting station, together with accessories, for the sum of £175,000. The purchase price does not include the shares of the former Emperor of Corea, of the value of £75,000. It is said that the time for the sale was very appropriate for the Americans, as the gas company was about to open its works. The tramway is of great importance to the Japanese, as its acquisition places the whole of the traffic in the city and environs in their hands.

Closed for the Holidays.—Messrs. Ferranti, Ltd., Hollinwood, announce that their works will be closed for the annual district holidays as follows:—Switch department, August 28th to September 4th, inclusive; meter department, August 28th to August 31st, inclusive. The offices will be open as usual.

Educational.—UNIVERSITY COLLEGE.—Prof. J. D. Cormack has been elected Dean and Prof. J. A. Fleming vice-Dean of the Faculty of Engineering for the session 1909-10, which will begin on Monday, October 4th. Special and postgraduate courses have been arranged to meet the needs of the following classes of students:—(*a*) Postgraduates and engineers in practice; (*b*) others whose qualifications are, in the opinion of the lecturer, such as to enable them to follow the courses. Each course will include lectures and exercises, and the numbers will be strictly limited. The following are some of the special courses for next session:—"Steam Turbines," by Mr. W. J. Goudie and Mr. E. G. Izod; "Railway Engineering," by Mr. H. Deans, of the Great Western Railway; "Roads, Street Paving and Tramways," by Mr. W. N. Blair, borough engineer of St. Pancras; "Electrical Design," by Mr. H. M. Hobart.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Electricity Committee has recommended the Wolverhampton T.C. to appoint MR. ERNEST STUBBS as technical and general assistant at the electricity works at a salary of £160 per annum, in succession to Mr. H. A. Howie, who has accepted a situation under the Sheffield Corporation; MR. J. S. DUDLEY, present station superintendent, as maintenance engineer, at his present salary of £156; MR. C. BELLHOUSE, as boiler house superintendent, at £125; MR. E. FORDER, the senior shift engineer, as engine room superintendent, at £120; and MR. F. C. PLATT, as junior assistant, at £78.

At the last meeting of the Bridlington Town Council the salary of the borough electrical engineer, MR. A. J. BECKETT, was increased by £25, with a further increase of £25 in 12 months to £300. The salary of the chief clerk of the electricity department, MR. T. E. MOTT, was increased by £13 to £117 per annum, with two further yearly increases of £6 10s., to £130 per annum.

MR. MORDY LAMBE, borough electrical engineer, East London, Natal, has intimated to the T.C. that he does not wish to continue in the service of the Council after the expiration of his agreement in November next.

At the Bradford Corporation Electricity Works recently, MR. CHAS. W. SALT, chief assistant to Mr. Thomas Roles, city electrical engineer and manager, was presented by the staff and employés with a brass-mounted oak clock and a calabash pipe on the occasion of his marriage with Miss Ida Potts, of Bradford. Mr. Roles, who made the presentation on behalf of the subscribers, spoke of the high esteem in which Mr. Salt was held in the department, and several members of the staff cordially endorsed his remarks. Mr. Salt suitably responded.

Tramway Officials.—At the Tynewydd Hotel, Porth, Glamorgan, a smoking concert was recently held to celebrate the anniversary of the opening of the Rhondda electric tramways. MR. H. J. NISBETT, the engineer and manager of the undertaking, was presented with a large portrait of the entire staff and employés.

The Keighley T.C. has appointed MR. ELI MURGATROYD as tramways manager.

The Morecambe T.C. has appointed MR. E. WALLING as traffic manager of the tramways.

Whilst watching the progress of the work of the renewal of the permanent way of the tramways at the junction of Babington Lane and St. Peter's Street, Derby, the manager of the Derby Corporation tramways, MR. F. HARDING, was knocked down and run over by a tandem cycle. Mr. Harding was badly bruised on his right side, and also suffered from shock.

General.—The managers of the new College to be opened in Dundee next month have appointed MR. ROBERT D. ARCHIBALD, B.Sc., A.M.I.C.E. and E.E., who is at present principal assistant to Dr. Magnus Maclean, Professor of Electrical Engineering in the Glasgow and West of Scotland Technical College, as lecturer on electrical and mechanical engineering. Mr. Archibald has an excellent record as a student in the Glasgow University and Technical College, was trained in mechanical engineering with the Fairfield Shipbuilding Co., of Govan, and as an electrical engineer with Messrs. Mavor & Coulson, of Glasgow, and the Electric Construction Co., of Wolverhampton. With the last-named company he was assistant for the design of electrical plant for several years.

Sanction has been given for the appointment of LIEUT. H. C. HAWTREY, Royal Engineers, as Adjutant of the London District Telegraph Companies, Royal Engineers, Territorial Force, and he will take up his duties about October 1st next. Mr. Hawtrey joined the "Scientific Corps" in August, 1900, and he is presently employed with the Royal Engineers at Limerick.

At a meeting of the Council of the Leeds Local Section of the Institution of Electrical Engineers, held at the Hotel Metropole on May 17th, 1909, Mr. W. M. Rogerson, President, in the chair, it was resolved that, in view of the approaching marriage of the Honorary Secretary, MR. HAROLD DICKINSON, and as some acknowledgment of his valuable services in founding the Leeds Section of the Institution of Electrical Engineers, and as its first chairman, together with the keen interest displayed by him in the interests of the Section as honorary secretary, and as a tribute of the high esteem in which he is held by all the members, a suitable wedding gift should be presented to him. The presentation was made on Thursday, August 5th, when an ornamental silver table centre was presented to him, along with the hearty good wishes of his fellow-members of the Society.

At Glasgow, on Saturday last, the marriage took place of MR. JAMES EDMUND SAYERS, M.I E.E., consulting engineer, to Margaret Wilson, only daughter of the late Mr. T. C. Robertson, C.A., of Glasgow.

With reference to the announcement in our last issue regarding the appointment of Mr. Ben Bailey, we are asked to state that he has taken up the position of "engineer," not "engineer and manager," to Messrs. J. & H. Grevener.

It is announced that Sir H. Babington Smith, Secretary of the General Post Office, will shortly resign that office, he having, at the request of the Government, accepted the post of President of the National Bank of Turkey. Sir Henry is to proceed to Constantinople in September.

Will Mr. H. Thurston Owens, consulting engineer of New York City, kindly forward a note of the address where he is staying in London.

Mr. Henry W. Warde, manager of the Glasgow branch of the General Electric Co., Ltd., sails on August 19th for Australia, on a tour of investigation on the company's behalf.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Ignition Syndicate, Ltd. (91,175).—Issue on July 12th of £500 debentures, part of series created November 12th, 1908, to secure £5,600, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £4,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).—Trust deed dated June 30th, 1909, to secure £667,500 debenture stock (with power to increase to a sum not exceeding half the nominal amount of the fully-paid capital, if the share capital fully paid be increased beyond £1,375,000), charged on the company's electrical undertakings, subject to Acts and Provisional Orders relating thereto, certain freehold and leasehold premises and the company's general assets, except uncalled capital. Trustees: Right Hon. Viscount Ridley and W. Cunliffe.

North Metropolitan Electrical Power Distribution Co., Ltd. (61,599).—Particulars of £20,000 debentures created June 17th, 1909, filed pursuant to Sec. 93 (5) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Potteries Electric Traction Co., Ltd. (57,968).—This company's annual return was filed on July 16th, when 245,000 preference and 245,000 ordinary shares had been taken up out of a nominal capital of £600,000 in £1 shares (300,000 preference). £423,340 has been been received on 178,340 ordinary and 245,000 preference, and £66,660 is considered as paid on 66,660 ordinary. Mortgages and charges: £245,000.

Europe and Azores Telegraph Co., Ltd. (39,452).—This company's annual return was filed on June 24th when the entire capital of £200,000 in £10 shares had been taken up. £144,320 has been paid, and £55,680 is considered as paid. Mortgages and charges: Nil.

Evershed & Vignoles, Ltd. (43,206).—This company's annual return was filed on July 8th, when the entire capital of £30,000 in £10 shares had been taken up. £30,000 has been received. Mortgages and charges: £16,800.

Robertson Electric Lamps, Ltd. (39,316).—This company's annual return was filed on July 14th, when 6,750 shares had been taken up out of a nominal capital of £100,000 in £10 shares. £66,845 has been paid on 6,650 shares, leaving £15 in arrears. £1,000 is considered as paid on 100 shares. Mortgages and charges: £10,000.

British Aluminium Co., Ltd. (41,104).—Two mortgages, charged on the company's undertaking and property, present and future, including uncalled capital, dated July 17th, 1909, and created by the receiver and manager for debenture stock holders, each to secure £20,000. Holders: (1) Sir Julius Wernher, Bart., L. Phillips, F. Eckstein and L. Breitmeyer (trading as Wernher, Beit & Co., at 1, London Wall Buildings, E.C.); and (2) W. H. and J. A. Morrison, 53, Coleman Street, E.C.

Wolfram (Tungsten) Metal-Filament Lamps, Ltd. (95,312).—Particulars of £40,000 debentures created April 30th, 1909, filed pursuant to Sec. 93 (5) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £30,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Yorkshire Electric Power Co.

The directors in reporting on the progress of the company for the half-year from January 1st to June 30th, 1909, state that the receipts from the sale of energy and for work charged out to consumers, &c., for the half-year ending June 30th last amount to £11,169; against, for the half-year ending June 30th, 1908, £8,698; and for the half-year ending June 30th, 1907, £4,700. The gross profit on the revenue account for the half-year is £2,599; against £1,250 for the half-year ending June 30th, 1908; and a gross loss of £403 for the half-year ending June 30th, 1907. After payment of mortgage interest the net revenue account shows a profit on the half-year just ended of £1,070; compared with a profit for the corresponding half-year in 1908, of £363; and a loss for the half-year ending June 30th, 1907, of £1,211. During the half-year further agreements have been made with power users to an extent equal to the average of preceding half-years; these include a number of contracts with collieries and other consumers on the Barnsley extension. The full benefit from these arrangement does not appear during the period under review. The demand for energy per horse-power connected has been low owing to the depressed state of nearly all the industries in the company's area; notwithstanding the adverse conditions of trade there has been a steady increase in the use of the company's supply. Owing to these increases it will shortly be necessary to install further generating plant for which space was reserved when the Thornhill power station was erected. The whole of the issue of £45,000 of second mortgages has been applied for and allotted. The directors are glad to report that Mr. Walter Geoffrey Jackson has consented to fill the vacancy on the board, and they have appointed him under the powers conferred upon them.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held at Newcastle-on-Tyne on 10th inst., Dr. J. T. Merz, the chairman, presiding. The report to June 30th showed that the surplus of receipts over expenses was £3,746, which, with the balance brought forward of £642, makes a total to the credit of profit and loss account of £4,388, and, after deducting interest on debentures, loans, &c., amounting to £1,142, there remains an available balance of £3,246. The directors propose the payment of dividend on the preference shares at the rate of 5 per cent. per annum, less income-tax, £574; dividend on the ordinary shares at the rate of 1 per cent. per annum, less income-tax, £669, placing to reserve for renewals, depreciation and other contingencies, thus increasing the amount to £7,000, £900; and setting aside for the reduction of registration and formation expenses, £330, leaving to be carried forward, £773. The amount available for division shows an increase of £790 as compared with the corresponding period of last year. The traffic receipts are £748 better than they were last year, though the depression in the trade of the district continues. Of the unissued preference shares 92 were applied for and allotted during the half-year, leaving 656 still unissued.

The Chairman, in moving the adoption of this report, said the traffic receipts showed an increase of £748, against a decrease of £1,251 last year. The causes of that decrease had not been really removed yet. It was true that the strike which was unfortunately existing last year had been settled, but, at the same time, the depression in trade was still very great. It was doubtful if there was actually much more work doing on the river now than at the corresponding time of last year. They must not forget that they were reaping some benefit by the stoppage of the river ferries. The tram-mileage was 338,790, against 332,100 in the corresponding period of last year. This increase was almost entirely due to workmen's traffic. The number of passengers carried was 147,676 more than in the corresponding half-year, which had shown a decrease on the previous half-year of 318,108. The receipts per car-mile were 8·26d., as against 7·89d.; and the expenditure per car-mile 5·84d. against 5·79d. The balance brought forward was £642, against £423 last year, and the balance carried forward was £773, against £728. The dividend that was proposed, compared with nothing last half-year. The depreciation fund had been increased from £5,500 to £7,000. In conclusion, he mentioned that the receipts for the first five weeks of this half-year showed an increase of £100, as against a decrease last year at this time of £211.

Mr. G. E. Henderson seconded the adoption of the report, which was agreed to.

South American Light and Power Co.

The sixth annual general meeting of this company was held on Tuesday at the London offices, 6, Lloyd's Avenue, Mr. F. H. Jackson presiding.

In moving the adoption of the report (see Electrical Review, August 6th, page 224) the Chairman said it would be seen from the profit and loss account that the receipts showed an appreciable increase over those of the previous year, an increase which was equal to 40 per cent. The result of the company's progress was that Clause 16 of the agreement made with the Bahia Blanca and North-Western Railway Co. in 1906 came into force. Under that clause the company paid to the railway company one-half of the profits earned after deducting debenture interest up to £5,000, that was to say, they received half of any profits made by the company up to a total of £10,000. The profit made by the company this year was £10,816, but out of that they had to pay the Bahia Blanca Co. the £5,000 to which he had referred, and the amount available for distribution was £5,274, as compared with £2,309. They had not been able to get rid of the dynamo which came into their possession when the Railway Co. took over the working of the company's business, but they had written it down to such a low figure that they had hopes it would soon disappear from the books. The capital now issued was £113,000, of which the £13,000 was for capital expenditure, and which had been paid for by the issue of shares to the Bahia Blanca undertaking.

Mr. T. P. Gaskell seconded the motion.

Replying to a Shareholder, the Chairman said the company were given to understand that the Bahia Blanca Co. were erecting a large station for the generation of electricity, and any further developments of the company would not, therefore, have to be met by large capital expenditure. It was reasonable to suppose that the expenditure in the future would not be on a large scale.

The report was adopted.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from August 18th to August 31st, 1909 (both days inclusive) for the preparation of warrants for interim dividends payable 31st inst., on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1909.

Charing Cross, Euston and Hampstead Railway Co.

The directors' report states that during the half-year ending June 30th, 1909, the capital expenditure amounted to £145,799, representing the expenditure which at the close of last half-year remained chargeable to the capital expenditure account No. 4. The gross receipts on revenue account amounted to £105,183, being an increase of £16,300 on the receipts for the corresponding half of last year. The working expenses amounted to £57,795, being an increase of £1,303. After providing for interest and rents, and reserving £3,000 for contingencies and renewals, there remains a balance of £18,813 available for ordinary dividend, and the directors recommend that a dividend at the rate of ⅝ per cent. per annum be declared on the ordinary shares, payable on August 14th, leaving £2,591 to be carried forward. The following table gives a summary of the working expenditure in comparison with the corresponding period of last:—

	Half-year ending June 30, 1909.	Half-year ending June 30, 1908.	Increase or decrease.	Per cent.
Maintenance of way and works, &c...	£4,053	£3,595	+ £458	+ 12·74
Repairs and renewals of rolling stock	3,357	3,021	+ 336	+ 11·12
Lift expenses	4,981	5,581	— 600	— 10·75
Train working and traffic expenses ..	38,134	37,290	844	+ 2·26
Other items..	2,403	2,161	242	+ 11·20
	£52,928	£51,648	1,280	+ 2·48
Rates and taxes	4,867	4,845	22	+ ·45
Total	£57,795	£56,493	1,302	+ 2·30

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June 30, 1909.	June 30, 1908.	Increase.	Per cent.
Passengers, including workmen and season-ticket holders' journeys	14,862,882	12,132,639	2,730,243	+ 22·50
Passengers at workmen's fares..	2,798,029	2,174,601	563,428	+ 25·45
Passenger receipts..	£109,787	£94,648	£16,139	+ 19·07
Average receipt per passenger..	1·63d.	1·67d.	Dec. ·04d.	— 2·40
Train-mileage	991,747	773,874	217,873	+ 28·15
Car-mileage	9,037,858	2,596,526	441,332	+ 17·00

Passengers (including season-ticket holders) carried since the opening of the railway:—

Half-year 30th June, 1907 (8 days)	421,466
31st December, 1907	9,881 357
30th June, 1908	12,132,639
31st December, 1908	13,015 368
30th June, 1909	14,862,882

Metropolitan District Railway Co.

The report of the directors for the half-year ending June 30th, 1909, which was submitted at the ordinary general meeting held on the 11th inst., shows that the expenditure on capital account during the half-year has been £34,959. The company's revenue continues to increase satisfactorily. During the half-year the gross receipts on revenue account have amounted to £273,318, being an increase of £25,419 on the receipts for the corresponding half of last year. The working expenses have amounted to £148,096, being a decrease of £6,733. After providing for interest and other charges and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £19,108 13s. 6d., and the directors recommend that a dividend at the rate of £3 per cent. per annum be declared on the 4 per cent. guaranteed stock payable on August 13th. The following table shows the working expenditure in comparison with the corresponding period of last year:—

	Half-year ended June 30th, 1909.	Half-year ended June 30th, 1908.
Maintenance of way and works	£31,844	£19,682
Maintenance of rolling stock	25,287	20,778
Train working and traffic expenses (including joint stations), after deducting the balance of accounts for work done for and by other companies	72,453	81,296
Rates and taxes (including joint stations) ..	16,386	19,721
Other items	12,126	13,352
Total	£148,096	£154,829

The following table gives a summary of comparative figures for the first halves of the years 1908 and 1909:—

	Half-year ended June 30, 1909.	Half-year ended June 30, 1908.	Increase.
No. of passengers, including workmen and season ticket holders' journeys..	32,949,895	29,626,586	3,323,509
No. of passengers carried at workmen's fares	6,005,454	5,463,794	542,660
Passenger receipts	£254,020	£229,632	£24,488
Average receipt per passenger	1·85d.	1·86d.	Dec. ·01d.
Train-mileage on District Railway ..	1,557,559	1,448 347	109,212
Car-mileage on District Railway ..	6,201,788	5,944,733	256,955

Lanarkshire Tramways Co.

The directors, in their report for the half-year ended June 30th, 1909, state that the half-year's working resulted in the earning of revenue amounting to £32,199 16s.; the expenses amounted to £17,686 12s., leaving a balance of £14,513 4s.; contributions to local authorities absorbed £794, and interest on debentures, £608, leaving £13,111, which, with £865 brought forward from December 31st, 1908, left a balance of £13,976 for distribution. The directors recommend a dividend of 5½ per cent. per annum for the half-year on the share capital issued prior to January 1st, 1909; also a dividend at the rate of 5½ per cent. per annum on the issue of 3,500 shares from due date of the instalments to June 30th, 1909, and that £5,282 18s. be carried to revenue new account. The directors regret to report that owing to continued trade depression the traffic receipts show a decrease of £1,764 as compared with the receipts for the corresponding half-year of 1908. The expenses, however, show a reduction of £1,306, mainly owing to the reduction in the car-mileage, to the price of coal being considerably lower, and to the fact that this half-year no legal expenses have been incurred in connection with Parliamentary Bills affecting the company's interests. The 3,500 shares offered for subscription in February last were fully applied for and allotted, and the construction of the extensions to Uddingston and Newmains completed and inspected by the Board of Trade on June 29th last. The new capital has, therefore, been quite unremunerative during the past half-year. Several additional cars have been purchased and are now in service. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Continental Notes.—Switzerland.—The report of the Banque pour Entreprises Electriques, of Zurich, for the last financial year shows a net profit of £175,167, as contrasted with £174,396. A dividend at the rate of 10 per cent. is maintained.

Poland.—La Compagnie d'Electricite de Varsovie, of Warsaw, reports a net profit of 240,204 roubles for the last financial year, as contrasted with only 178,683 roubles in the preceding 12 months. A dividend at the rate of £1 4s. per share is being declared.

City of Buenos Ayres Tramways Co. (1904).—The directors have declared a dividend of 1s. 3d. per share, less tax, for the three months ended June 30th. The dividend was the same last year.

Guildford Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the preference share capital of the company for the half-year ending June 30th, 1909, at the rate of 6 per cent. per annum.

Consolidated Electrical Co., Ltd.—The directors have declared a dividend of 3 per cent. (7½d. per share), less income-tax, on the ordinary shares for the year; £7,385 is carried forward.

Telegraph Construction and Maintenance Co., Ltd.—Sir James Pender presided at the half-yearly meeting held on July 27th, and, in the course of his address to the shareholders, stated, according to the *Times* report, that the works were actively employed and the ships were at sea. The *Colonia* was laying a new cable and picking up an old one, and the *Cambria* was away replacing a broken cable, both ships being on the other side of the Atlantic. They had fitted them during the last six months with the Marconi wireless apparatus, which they hoped might prove of use in the future. The transmission of news to a ship at sea was a special preserve of wireless telegraphy. As to their new vessel, the *Telconia*, the completeness of her arrangements had been generally appreciated by experts. This year the company had made and laid a heavier type of cable than they had ever had to deal with before. It weighed 62½ tons to the mile, and was designed to resist the crushing strain of icebergs grounding on the coast of Newfoundland.

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

Wednesday, August 18th.—National Telewriter Co., Ltd.—77,089 preferred ordinary shares of £1 each, 12s. 6d. paid, Nos. 30,001 to 107,089.

And ordered the undermentioned securities to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—640,000 5 per cent. cumulative first preference shares of £5 each, fully-paid, Nos. 1 to 640,000; 500,000 5 per cent. cumulative second preference shares of £5 each, fully-paid, Nos. 800,001 to 1,300,000; and £1,733,337 4½ per cent. debenture stock, in lieu of the first, second and third preference shares now quoted.

Application has been made to the Committee to appoint a special setting day in and to grant a quotation to—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Scrip, fully and partly paid, for £248,500 4½ per cent. Consolidated first mortgage debenture stock.

Prospectuses.—*Sahang Rubber Estates, Ltd.*—The list was to close on Wednesday in an issue of 40,000 ordinary shares of £1 each. The company acquires the Soengei Sahang Rubber Estate, 3 miles from Pontianak, Dutch West Borneo. Out of 2,060 acres, 230 are already planted with Para rubber, some 16,000 trees being 2 to 2½ years old, and 7,600 from 17 to 19 months old.

Beira Rubber and Sugar Estates, Ltd.—The list was to close yesterday in an issue of 150,000 6 per cent. participating cumulative preference shares of £1 each. The estates to be purchased are on the Buzi River, Beira, East Africa, and have a total area of 50,000 acres. 60,000 rubber trees are already planted, and planting is to proceed at the rate of 100,000 trees per annum.

Pará Rubber and Produce Estates, Ltd.—This company has been offering 39,947 shares of £1 each for subscription at par.

National Boiler and General Insurance Co., Ltd.—The dividend and bonus for the year is 20 per cent. £9,000 has been added to current risk and reserve fund, £6,865 being carried forward.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend in respect of the half-year ended July 31st at the rate of 5 per cent. per annum, less income-tax.

Great Northern and City Railway Co.

The Earl of Lauderdale, chairman, presided on the 4th inst. over the half-yearly general meeting of the above company, held at Salisbury House, E.C.

In moving the adoption of the report (see Electrical Review, August 6th, page 227), the Chairman said the total receipts were £40,802, as against £46,476 for the corresponding half-year of 1908, a difference of £5,674. The working expenses were £21,040, as against £23,286, giving a saving of £2,246. The percentage, however, was slightly higher, owing to decreased revenue, viz., for the half-year under review it was 51·56 per cent., against 50·10 per cent. for the corresponding half-year. The result of the accounts was that they were short by £3,209 on their fixed charges. With regard to the general balance-sheet, taking it shortly, the capital account was £197,066 in debt, the same as last half-year, with available capital assets, £580,200. Revenue account was in debt £24,518, towards which there was a cash balance of £11,856; stores, £6,165; account due to company, £6,283; and accounts paid in advance and amounts adjusted £214. There had been a reduction of 80,472 car-miles, which was correspondingly greater than the decrease in traffic. The train-miles had, however, only decreased to the extent of 4,164. The reason these had not diminished to correspond with the decrease in traffic, was that the train service had been maintained at a high level, although the trains had been shortened in length, thus reducing the car-mileage. There had been no material change in the position of the company as regarded capital, but they had since the 1st inst., in conjunction with the City and South London Tube, commenced to run an earlier service on Sunday mornings. It was on July 1st of last year that the Great Northern Railway Co. altered their train service which affected them so adversely, and on July 9th the electrification of the L.C.C. tramways to Finsbury Park was completed. Since those dates there had been no change in external conditions. The total traffic showed a decrease of 833,847 passengers. The falling off experienced in the previous year had continued, although to a less extent, for whilst in December, 1908, they showed a loss of 27 per cent., as compared with December, 1907, in the year under review, they had lost only 13 per cent. He had little doubt that during the current half-year they would show better results than they did last year. During the past half-year the board had been giving full attention to traffic problems, and perhaps he might say that the tube railways of London were now working in close harmony by means of frequent meetings amongst the chief officials of the railways, which led to joint advantages. As he explained at the last meeting, their fares were governed by an arrangement with the Great Northern Railway. The necessary notice to terminate the arrangement had been given, and the required period had just expired. They had not yet made any alteration, owing to the discussions which were in progress with that company, and which might obviate any necessity for doing so. Until those negotiations culminated in some understanding one way or another, they had refrained from making any changes. Meanwhile, the deficiency of £3,209 in their fixed charges had again been provided from the same source as on the last occasion. The time for extending to the Bank as sanctioned by Parliament, expired next August, and the directors were not yet in a position to say whether application for an extension of the period should again be made. In conclusion, the chairman referred to the death of the late secretary and the appointment of Mr. W. M. Ballingall to the office.

Mr. Charles Steel seconded the motion.

Mr. Fell congratulated the board on the economies they had effected, but hoped they would persist in an effort to "moralise" the Great Northern Railway directors. He trusted also that the L.C.C. would be brought to see the unwisdom of running tramways at fares which were unremunerative.

The motion was then carried.

Central London Railway Co.

Sir Henry Oakley (chairman) presided on August 5th, at the Holborn Restaurant, W.C., over the twenty-eighth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, July 30th, page 188), the Chairman said there was practically no change in the capital account. In round figures they had £100,000 of unissued capital, but with what they had put to reserve, and their daily receipts, they were enabled to keep going without issuing any further capital. The revenue would interest them chiefly because the circumstances of the times had rendered necessary some alteration in their dealings with the fares, and because also, through the weather, or the dullness of trade, or both, there had been a damaging effect on the receipts. Whilst the expenses remained practically unaffected, the receipts for the year were £20,000 less than in the corresponding period. The bald statement might, however, convey a more serious impression than the facts really justified. In the first place, in the previous year they had the exhibition traffic, and so far as they could ascertain, the traffic last year benefited them to the extent of £6,000. That traffic had practically been a net loss this year. A further striking fact, however, was the loss of workmen's traffic. As they knew, workmen were carried for any distance for 2d., and there was no question of the fare or the accommodation being responsible for the loss. They had lost 445,000 workmen passengers, and it could only be accounted for by a diminution of work, because there was no better means for them to get to it and no better attraction in the shape of fares. The next and most important point was that of the fares for their general traffic. They found that week after week there was a very heavy falling-off in the general traffic, and especially in regard to short-distance passengers. They took censuses to find out whether this was due to any accidental circumstances, and they examined the rival modes of conveyance, and they found that without doubt the means of locomotion in the streets were so numerous and so convenient, that passengers preferred to ride on a 'bus and pay 1d. rather than to descend to the railway and pay 2d. The board accordingly determined to face the experiment of charging 1d. for any three stations. The results had been that their traffic week by week gradually increased, until within the last six weeks they found they were conveying rather more than double the number of 2d. passengers they had lost prior to the date at which they made the change. The consequence was that they had got the money back, but they had to carry double the number of passengers for it. They hoped, however, there was a gradual indication that the number of passengers would still further increase. They had not as yet had a sufficiently long experience to make calculations with actual certainty, and, therefore, they had withheld any announcement as to whether they would go on with these fares or not. Further, he would point out that as the result of the system of through bookings they had carried 3,000,000 of passengers, which was an increase of rather more than 1,000,000 over the corresponding period. There were indications month by month that these facilities were appreciated by the public, and that the traffic would increase. At the same time, it must not be forgotten that they did not receive so large a fare as if people travelled altogether on their line and paid the local fares. Notwithstanding what he had said, they were able to pay 3 per cent. dividend as before, and to carry £40,000 forward, which was practically equal to the amount brought into the accounts. Therefore, they had not trenched on the savings they had in hand, and they had been able to maintain the dividend. The only other point was their Bill to extend to Liverpool Street, which had passed both Houses of Parliament, and was awaiting the Royal Assent. The result of the inquiry, aided as it was by the Great Eastern Railway Co. and the London and North-Western Railway Co., satisfied the board that there was no point so rich in promise and so full of traffic as that which centred round Liverpool Street.

Lord Rathmore seconded the motion.

Answering questions, the Chairman said the company had tried to coax their competitors to adopt reasonable fares, and failed. He was told the 'bus traffic was not paying, so perhaps they would yet come to their senses. The buildings over the stations did not belong to the company, but were erected by private persons, who paid handsome ground rents.

The report was adopted.

Chilian Electric Tramways and Lighting Co., Ltd.

Sir Julius Wernher (Chairman) presided on August 5th, at 1, London Wall Buildings, E.C., over the eleventh ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, August 6th, page 224), the Chairman said the operations of the company during the past year had shown an improvement both in the tramways and lighting departments. The tramways had shown increased earnings of £10,000, and the lighting department of about £8,000, and these results, he thought, were an earnest of better things to come. They had carried over 7,000,000 more passengers than last year and supplied more current to the extent of one million pesos without satisfying all the demands, and both branches were capable of further development. If the return did not make a better showing, it was to a great extent due to the low rate of exchange, and he was sorry to say there was not much improvement this year. Last year he mentioned that Mr. Carl Müller was appointed as managing director, and he proceeded to Santiago in February of last year, and remained till April of this year. During that period he completely reorganised both the tramway and lighting departments, and the results were beginning to show themselves in the improved character of the returns for the six months of the present year, both departments showing increased profits over the same period of last year. By the terms of the concession, the company was entitled to double the tariff at night, but that had been contested by the municipality of Santiago; the arbitrators were called in and decided in the company's favour. The municipality were not satisfied, and asked for a decision of the courts, and again a verdict was given in favour of the company, and the result should have a favourable effect on the tramways returns, as for months past they had been deprived of what was lawfully due to them. They were still endeavouring to come to a final compromise with the municipality on the tariff and other matters. It was anticipated that the water power scheme would be in full operation before the end of the year, and it ought at once to make its influence felt in their operating expenses, and consequently increase their profits. Their coal bill had been enormous, and owing to bad transit facilities, notwithstanding all their care, they had been left with a very small supply of coal which had caused great anxiety to the staff. Since the departure of Mr. Müller, Mr. Kolkhorst, who had been general manager of the Valparaiso tramways for some years, had been appointed general manager of the company.

Mr. Ludwig Breitmeyer seconded the motion, which was adopted without discussion, and £1,200 was granted to the directors as their remuneration.

Liverpool Overhead Railway Co.

In presenting the half-yearly statement of capital and revenue accounts to June 30th, 1909, the directors have to report that the gross revenue receipts amount to £35,188 and the working expenses to £27,373. The number of passengers carried during the last two years is as follows:—Half-year ending December, 1907, 5,804,629; June, 1908, 5,367,286; December, 1908, 5,167,464; June, 1909, 4,900,216. There has been a further shrinkage in passenger traffic during the past half-year, resulting in a reduction in the revenue of £2,487; this decrease in traffic is mainly attributable to the depression in trade. The directors, by introducing a more frequent but less costly service of trains and effecting other small economies in working expenses, have made a saving of £3,138. The structure and the rolling stock have been maintained in efficient condition. The sum of £1,500 has been carried to the credit of renewal fund, which now amounts to £38,082. The directors have to record with regret the death of Sir Edward Lawrence, who was one of the original directors, and who has rendered to the company very valuable service. The total revenue amounted to £35 188 and the working expenses and transfer to renewal fund to £27,373, leaving £7,815, from which is deducted interest on mortgage debentures and on calls paid in advance (£4,329), leaving £3.486; this amount, together with the balance brought forward (£4,210), leaving available for dividend £7,696. Out of this balance the directors recommend the declaration of a dividend at the rate of 5 per cent. per annum on the (1892) preference shares, less income-tax, leaving a balance of £4,696 to be carried forward to next half-year.

Singapore Electric Tramways, Ltd.

The ordinary general meeting of this company was held on the 3rd inst. at the London offices, 19, St. Swithin's Lane, E.C., Mr. Edmund Davis presiding in the absence of Sir Frank A. Swettenham.

The Chairman, in moving the adoption of the report (see Electrical Review, August 6th, page 224) said that in reference to the item creditors and credit balances on the debit side of the balance-sheet which stood at £6,701, that was a reduction of nearly £4,000 as compared with 1907, when it stood at £10,693. Turning to the other side of the accounts, on the tramway undertaking there had been an outlay of £12,884, or nearly £4,500 more than last year, though they had written off a little over £10,000, as against £13,000 in 1907. That re-arrangement of the provision for depreciation had been arrived at after careful consideration, and on the advice of the general manager, who had advised them that owing to the excellent condition of the plant, the reduced rate was justified. They had only £6,000 on loan against security to compare with £15,000 in 1907. Debit balances and stocks and stores, tickets, coals and sundries were about the same for the two years, and the balance of profit and loss account had been increased by £4,040, making the total under that head £16,217, which was caused by the large amount debited to the profit and loss account from year to year by way of depreciation. The total receipts for the year were £917 less than in the previous year, and they had debited the profit and loss account with depreciation amounting to £10,233, debenture interest, 17,500, and the royalties payable to the Singapore Municipality, and the accounts showed a loss for the year of £4,040. The item, commission and discount, £740, was again heavy, but that was due to the loss incurred on the sale of subsidiary companies, and although they had been in communication with the Government, they had not, up to the present, been able to come to any satisfactory arrangement. The total traffic receipts amounted to £55,985, or very nearly 4 per cent. less than in 1907; the receipts per car-mile being 6·89d., as against 7·41d. in the previous 12 months. The falling off in revenue was due to a large extent to the depression in trade. The receipts for the current year up to July 1st showed an increase over the corresponding period of 1908 of $7,070. The tramway expenses amounted to £36,086, or an increase of about 2·8 per cent., though the cost per car-mile was 3·99d., as against 4·07d., the reduction being due to the fact that 63,104 more car-miles had been run. Turning to the other side of the business, the receipts from the sale of energy for lighting and power purposes showed a gratifying increase of $31,126, as against $15,999, or a little short of double the amount in 1907. That branch of the company's business was full of great potentialities, and as further connections were made the returns should increase largely. Up to April 30th of this year the receipts showed an increase of 48 per cent. when compared with 1908. The section of the tramways over the Singapore river had not yet been completed owing to the bridge which was being built by the municipality not yet having been completed. The general expenditure at Singapore would in the future show a reduction, as they had made arrangements with their local agents whereby their remuneration would be greatly reduced.

Sir Charles Petrie seconded the motion, and the report was adopted.

Baker Street and Waterloo Railway Co.

The directors' report for the half-year ending June 30th, 1909, states that the capital expenditure during the half-year amounted to £71,880, representing the expenditure which, at the close of last half-year, remained chargeable to the capital expenditure account. The share capital still remaining to be issued to the contractors under the construction contracts, amounts to £33,000. The gross receipts on revenue account during the half-year have amounted to £91,510, being an increase of £7,982 on the receipts for the corresponding half of last year. The working expenses have amounted to £42,224, being a decrease of £3,228. After providing for interest, rents and preference dividend and reserving £4,000 for contingencies and renewals, there remains a balance of £18,304 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1½ per cent. per annum be declared on the ordinary shares, and an additional dividend at the rate of 1½ per cent. per annum (making 3 per cent. per annum in all) on the ordinary shares other than those held by the Underground Electric Railways Co. of London, Ltd., or their nominees, leaving a balance of £3,106 to be carried to next half-year's account. The directors propose that the dividends shall be payable on August 14th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending June, 1909.	June, 1908.	Inc. or dec.	Per cent.
Maintenance of way and works, &c.	£2,996	£2,564	+ £432	+ 16·85
Repairs and renewals of rolling stock	2,939	3,687	— 748	— 20·29
Lift expenses	4,207	4,619	— 412	— 8·92
Train working and traffic expenses ..	24,787	27,574	— 2,787	— 10·11
Other items	2,905	2,692	+ 213	+ 7·91
	£37,834	£41,136	— 3,302	— 8·08
Rates and taxes	4,390	4,317	+ 73	+ 1·69
Total	£42,224	£45,453	— 3,229	— 7·10

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June, 1909.	June, 1908.	Inc.	Per cent.
Passengers, incldg. workmen and season-ticket holders' journeys	14 325,065	12,940,801	1,384,264	+ 10·70
Passengers at workmen's fares ..	1,922,539	1,874.140	48,399	+ 2·58
Passenger receipts..	£86,861	£79,869	£6,992	+ 8·75
Average receipt per passenger ..	1·46d.	1·48d.	Dec. ·02d.	— 1·35
Train-mileage	637,202	522,406	114,796	+ 21·97
Car-mileage	1,918,562	1,770,126	148,436	+ 8·39

The terms of the agreement with the North-West London Railway Co., referred to in the directors' last half-yearly report, which provided for the working by this company of the projected railway from Edgware Road to Brondesbury, were settled, subject to confirmation by the shareholders, but it did not become necessary to seek such confirmation, as the Bill of the North-West London Railway Co. did not pass through Parliament. After the decision of the Committee of the House of Commons on the North-West London Bill, the Bill of this company for an extension of time for constructing the authorised Paddington extension was withdrawn. The policy of the company in relation to any future proposals which may be made by the North-West London Railway Co. as to constructing a railway from Edgware Road to Brondesbury is being considered. The extension to Paddington, which this company have power to construct, was so laid out on the Parliamentary plans that if it were constructed any extension beyond Paddington would be practically impossible, and its construction would also debar the company from arranging to work, as a continuous line, any extension in the direction of Brondesbury and Cricklewood, which, in the opinion of the directors, would be of more value than the Paddington extension. In these circumstances, the directors recommend that the Paddington extension, as authorised, should be abandoned, and all questions as to extension of the railway beyond Edgware Road left for future consideration.

Great Northern, Piccadilly and Brompton Railway Co.

The directors' report for the half-year ending June 30th, 1909. The capital expenditure during the half-year amounted to £169,488, representing the expenditure which, at the close of last half-year, remained chargeable to the capital expenditure account No. 4. The gross receipts on revenue account amounted to £157,993, being an increase of £10,230 on the receipts for the corresponding half of last year. The working expenses amounted to £73,405, being a decrease of £1,579. After providing for interest, rents and preference dividend, and reserving £6,000 for contingencies and renewals, there remains £33,292 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving a balance of £8,352 to be carried to next half-year's account. The dividends will be payable on August 14th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending June 30, 1909.	June 30, 1908.	Inc. or dec.	Per cent.
Maintenance of way and works, &c...	£5,890	£4,235	+ £1,655	+ 39·08
Repairs and renewals of rolling stock	4,696	5,055	— 359	— 7·10
Lift expenses	7,153	7,480	— 327	— 4·37
Train working and traffic expenses	41,585	47,513	— 5,928	— 12·48
Other items	6,005	3,172	+ 2,833	+ 89·31
	£65,329	£67,455	— £2,126	— 3·15
Rates and taxes	8,076	7,528	+ 548	+ 7·28
Total	£73,405	£74,983	— £1,578	— 2·10

The following table gives a summary of comparative statistics for the first halves of the years 1908 and 1909:—

	Half-year ending June 30, 1909.	June 30, 1908.	Inc.	Per cent.
Passengers, including workmen and season-ticket holders' journeys ..	19,155,883	17,446,477	1,709,406	+ 9·80
Passengers at workmen's fares ..	2,442,573	1,977,422	465,151	+ 23·52
Passenger receipts	£151,073	£142,111	£8,962	+ 6·31
Average receipt per passenger ..	1·89d.	1·95d.	dec. ·06d.	— 3·08
Train-mileage	1,236,920	956,988	279,887	+ 29·20
Car-mileage..	8,671,512	8,742,507	dec. 70,995	— 1·20

The number of passengers carried, including estimated journeys by season-ticket holders, is as follows:—

Half-year ending June 30th, 1908	17,446,477
" " December 31st, 1908	16,990,501
" " June 30th, 1909	19,155,883

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.‡
Aberdeen	Aug. 4	3,181	— 619	9	14,142	— 827	..	..
Ayr	„ 7	999	— 61	12	4,804	— 232	8	..
Bath	„ 4	2,231	+ 45	31	23,505	+ 943	..	..
Belfast	„ 6	7,788	+ 279	18	71,182	+ 3,015	37	..
Birkenhead	„ 7	2,286	— 58	18	20,098	— 515	18·63	..
Birmingham Corp.	July 31	13,701	+ 167	18	116,628	+ 3,349	..	..
Blackburn	„ 21	2,252	— 151	17	19,357	— 628	13·97	..
Blackpool-Fleetw'd	Aug. 7	3,648	+ 47	5	7,315	— 81	..	..
†Bolton	„ 1	2,210	— 230	18	41,989	— 990	26	..
Bournemouth	„ 4	4,282	— 201	18	80,841	— 234	21·96	..
Bradford	July 31	9,732	— 310	17	86,444	+ 1,051	54·9	..
†Brighton	Aug. 1	1,218	— 66	18	17,123	..	9·5	..
Bristol	„ 6	13,587	+1,096	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	July 30	394	+ 6	30	6,491	— 138	3·65	..
Barnsley	„ 30	835	— 33	„	4,976	— 237	..	..
Barrow	„ 30	598	— 88	„	6,716	— 568	5·37	..
Cavehill	„ 30	214	+ 7	„	2,526	— 182	..	..
Devonport	„ 30	750	— 251	„	10,989	— 2,554	8·85	..
Gateshead	„ 30	2,054	..	„	22,728	— 316	11·25	..
Gravesend	„ 30	542	+ 60	„	6,664	— 159	6·5	..
Greenock	„ 30	1,373	+ 30	„	15,942	+ 222	7·25	..
Hartlepool	„ 30	549	— 63	„	6,750	— 228	6·72	..
Kidderminster	„ 30	268	— 37	„	3,019	— 240	..	..
Leamington	„ 30	423	— 12	„	5,004	+ 151	..	..
Merthyr	„ 30	425	— 12	„	6,330	+ 44	2·9	..
Metropolitan	„ 30	13,683	+ 575	„	180,713	+14,019	23	..
Middleton	„ 30	714	— 123	„	9,977	— 332	8·5	..
Mid. Joint Com'tee	„ 30	11,529	— 172	„	168,979	— 2,270	..	..
Oldham—Ashton	„ 30	1,166	— 56	„	16,664	— 1,084	9·18	..
Peterborough	„ 30	265	— 25	„	3,496	— 205	5·31	..
Potteries	„ 30	3,529	— 198	„	52,976	— 1,443	29	..
Rothesay	„ 30	1,464	— 160	„	5,578	— 230	2·75	..
Southport	„ 30	720	— 50	„	8,340	— 288	8·17	..
S. Metropolitan	„ 30	1,715	— 178	„	22,960	— 480	..	..
Swansea	„ 30	2,023	— 36	„	27,895	+ 452	12·5	..
Tynemouth	„ 30	905	+ 110	„	6,521	+ 156	3·75	..
Weston-s-Mare	„ 30	542	— 100	„	3,334	— 64	8	..
‡Worcester	„ 30	643	— 13	„	8,024	— 141	5·75	..
Wrexham	„ 30	199	— 23	„	2,861	— 146	..	..
Yorks. Wool. Dist.	„ 30	2,087	— 60	„	26,811	— 566	17	..
Miscellaneous	„ 30	472	+ 2	„	6,015	+ 3	..	..
Burnley	Aug. 7	2,689	— 185	..	..	..	..	..
Burton-on-Trent	„ 8	623	— 29	19	5,084	— 163	6·63	..
†Bury	„ 1	2,208	— 237	17½	21,073	— 769	22·5	..
†Cardiff	July 24	2,429	+ 93	17	36,338	— 910	..	..
Carlisle	Aug. 7	400	— 24	31	5,108	— 212	..	..
Chatham and Dist.	„ 5	1,982	— 174	31	24,626	+ 1,172	14·98	·61
Cork	„ 5	1,088	— 12	31	13,334	— 876	..	..
Croydon	July 30	3,006	— 98	..	26,119	— 29	11·25	4·75
†Darlington	Aug. 7	191	— 26	19	3,555	+ 258	..	..
Darwen	„ 6	449	— 42	18	4,616	— 224	4·36	..
Dover	July 31	491	— 131	18	8,660	— 478	4·75	..
†Dublin	Aug. 6	12,483	— 238	..	31,423	— 286	54·25	..
Dundee	„ 4	2,489	— 135	11½	13,852	— 613	15	..
East Ham	„ 7	2,096	+ 76	18½	19,081	+ 2,692	8·43	·68
†Exeter	July 30	340	— 30	18	6,212	+ 514	5·5	..
Glasgow	Aug. 7	31,344	—1,423	..	162,017	— 4,566	90·5	1·5
Hastings	„ 5	3,011	— 324	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 7	5,496	+ 230	18	46,496	+ 694	18	..
Ilkeston	„ 4	299	— 46	18	2,449	— 219	..	..
Ipswich	„ 7	1,076	— 41	19	7,712	— 24	10·5	..
†Kilmarnock	July 31	286	— 7	11	1,748	— 86	4·25	..
†Lan'kshire Trm. Co.	„ 22	3 635	+ 113	29	36,202	— 1,697	17·62	1·18
Lancashire United	Aug. 4	2,696	— 434	31	40,702	— 339	..	..
Leeds	July 31	13,689	— 123	18	120,355	+ 227	51	..
†Leicester	Aug. 7	4,331	— 257	..	..	..	..	..
†Leith	July 24	1,408	+ 114	10	6,432	+ 534	6	..
Liverpool	„ 31	22,201	— 220	30	392,407	— 3,831	104	..
‡L.C.C.	„ 24	75,832	+4,125	..	598,609	+22,523	121	4·25
London United	Aug. 7	15,343	—3,806	..	187,490	—20,076	..	..
Lowestoft	July 24	480	— 85	43	6,585	— 786	3·5	..
†Manchester	Aug. 7	30,835	—3,027	19	282,798	— 4,557	90·5	6
†Newcastle	July 31	3,8 0	+ 10	..	69,231	— 1,416	..	..
†Newport	„ 31	672	— 41	18	11,874	— 382	14·5	..
Oldham	Aug. 8	3,790	— 420	19	37,051	— 2,650	23·75	..
Pontypridd	„ 7	993	— 14	18½	7,963	+ 1,076	5·5	1·75
Portsmouth	..	..	..	..	..	..	..	..
†Preston	„ 4	1,442	— 90	..	..	..	..	..
Rotherham	„ 5	1,179	— 157	18	10,902	— 481	10	·66
Salford	„ 2	8,914	—1,216	17⅝	82,622	— 3,017	..	..
†Sheffield	„ 1	5,452	— 392	18½	108,787	— 1,618	37	1·25
Southampton	„ 4	2,560	— 216	18	19,643	— 686	..	..
Southend-on-Sea	„ 4	1,788	+ 228	18	10,079	+ 1,711	..	..
†South Shields	July 31	1,909	— 111	17⅞	9,975	— 56	..	..
Swindon	Aug. 7	260	— 52	..	..	..	..	..
Tyneside	„ 4	964	— 52	5	2,384	+ 100	..	..
Wallasey	July 31	1,962	— 96	17½	16.725	+ 413	..	·22
Walthamstow	Aug. 7	1,568	— 221	19	12,957	— 7	9	..
West Ham	July 29	4,759	+ 251	17	40.940	+ 2,411	15	·8
Wolverhampton	Aug. 4	1,745	— 132	18	14,907	— 908	12·5	..
Baker St.-Waterloo	„ 7	5 895	+ 525	5	15,480	+ 950	4·26	..
Cen. London Rly.	„ 7	9,851	—3,301	5	26,180	— 9,775	6·93	·55
Char. +, Bus. Hamp.	„ 7	7,365	+ 610	5	19,185	+ 2,650	7.75	..
City & S. Lon. Rly.	„ 8	6,162	+ 339	5	15,421	+ 976	7·2	..
Dublin-Lucan Rly.	„ 6	860	— 18	5	866	— 7	7	..
G.N. and City Rly.	„ 7	2 382	— 3	5	6,851	— 27	3·5	..
G.N., P'y. & Byrns.	„ 7	9,610	+ 315	5	26,045	+ 825	9·25	..
L'pool Overh'd Rly.	„ 8	3,111	— 10	5	8,987	— 58	6·8	4·3
†Llandudno-Col. Bay	July 30	534	— 8	35	7,544	+ 1,628	..	..
Mersey Railway	Aug. 7	3,986	+ 164	5	9,772	+ 469	4·5	..
Metropolitan Rly.	„ 7	30,907	+ 692	..	80,785	+ 1,702	24·5	..
Met. District Rly.	„ 7	18,538	+1,470	5	49,863	+ 4,757	24	..
Anglo-Argentine	„ 5	74,079	+3,553	..	1,206,285	+69,078	..	..
§Auckland	July 16	18,418	+1,508	28	96,514	+18,296	22·3	5·1
Bombay (B.E.T.)	„ 8	5,998	+ 367	26	68,178	+ 4,081	..	..
§Brisbane	..	16,140	+2,114	..	..	..	..	..
§Brit. Columbia Rly.	June	41,365	+8,826	..	..	..	..	..
Calcutta	Aug. 7	6,406	+ 157	..	..	..	..	..
§Cape Electric T. Ld.	June	11,908	..	..	..	..	..	..
§Kalgoorlie, W.A.	July	3,609	..	30	26,188	..	30·5	..
Madras	„ 31	1,276	+ 83	30	17,662	+ 170	..	..
§Melbourne	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Aug. 6	2,580	— 19	30	43,956	— 47	28	·74

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Markets in the Stock Exchange are mostly hard as regards prices, limp as regards business. The electricity sections synchronise with the other departments, and the principal divisions display a fair amount of strength. The telegraph list contains a number of small improvements. But the holiday spirit is very much in the air, and the closing of the Stock Exchange on Saturday week was announced amidst cheers.

Central London stocks are looking up again, and the success of the company's policy of penny fares is no longer in doubt. Regarded as rather a bold experiment at the time of its initiation, a good many proprietors were inclined to criticise the innovation as being likely to do the company more harm than good; but the event is apparently falsifying these objections, and the market has taken a distinct turn for the better, a rise of 2 in the Ordinary being the immediate outcome.

Other tube issues are steady. The excellent reports of progress lately published by the Underground Railways group has directed further attention to the various Debenture stocks, amongst which Baker Street and Waterloo stands at 99, Great Northern and Piccadilly at 95 and Charing Cross at 93. Piccadilly Preference are 8¼.

City and South London Ordinary is without change, and would-be buyers of the Preferences find much difficulty in getting the offer of any of the stocks. Of the old undergrounds, Metropolitan Consolidated is a trifle easier, while Districts remain at 17½. After arousing a little interest in connection with the coal-trade dispute and its settlement, the Home Railway market has relapsed, as a whole, into its usual condition of stagnation.

Anglo-American Telegraph stocks play the leading part in their particular market, and the Deferred has jumped up more than two points. There is a report current to the effect that the company has picked up the cable that for so many years has been lost, but a more prosaic explanation of the rise in the stock is that which credits the company with doing very good business at the present time. The Ordinary and Preferred are also better.

Great Northern Telegraphs are firmer, notwithstanding the shrinkage in the profit for the last financial year. Direct United States shares recovered half their fall of a week ago, and Cuba Telegraphs are 2s. 6d. higher. Eastern Telegraph Ordinary hardened, and "China" shares kept firm. A rise of 5s. in Globe Preference shows that investors are not unmindful of the recent improvement in Telegraph descriptions.

Telephones are quiet. National Telephone Deferred gained ½ of its deducted dividend, but the Third Preference slipped back further. American Telephone lost ½ of the sharp rise last week.

The rubber market has been rather badly shaken by a slump occasioned through a rush of profit-taking. As with all markets that are at all limited in extent, a gentle pressure to realise was quickly converted into a kind of *sauve qui peut*, accelerated by the wild efforts of Mincing Lane operators to land the Stock Exchange with the shares. The little burst did not last long, and the market quieted down at the lower levels, which tempted new buyers. However, the incident provided rather a nasty jar for speculators who, rashly gambling with borrowed money, failed to time the slump, and found themselves in such position that they might be called upon to pay differences of substantial amounts.

In the hot weather, electric lighting shares are about the last thing that investors trouble about, so it is not surprising that the catalogue should show hardly a change worth noticing. There is a sprinkling of small declines.

Mexican-Canadians have swung upwards this week; there has been a rise of 5 points in Mexican Light and Power Common. The Tramways Company shares are 1½ up, Rio Trams keep about 90½ and Sao Paulo at 150½ are 3 better. Canadian General Preferred at 118 is up 1, but the Common has not moved from 123. Tramway shares generally are steady. British Electric Traction Debenture stocks have fallen further. London Uniteds are without change.

The manufacturing group is quiet. Babcock gained ⅛, armament shares are strong, and Henley's rose 5s. Telegraph Constructions are up again. Edison & Swan fully paid shares from £2 were marked down to 1¼. In point of fact the latter price has more correctly represented the actual quotation for some time past, but the dealers prefer to treat their prices tenderly until obliged to put them down.

Liverpool District Lighting Co., Ltd.—The directors have declared an interim dividend of 4 per cent. per annum, less income-tax, for the past half-year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Aug. 3rd.	Closing Quotations Aug. 10th.	Business done week ended Aug. 10th, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅜ — 3½	2⅜ — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 96	53 — 96	..	..	+ ½	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	146½—147½	146 —147	146½	..	— ½	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 0 10
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	58 — 60	59 — 61	59	..	+1	5 6 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	102 —103	102½	101½	+1	5 16 6
3,220,770	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	17½ — 17⅞	19½ — 19⅞	19 7/16	17 7/8	+2½	2 0 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅛	8 — 8⅛	8⅛	..	..	4 14 1
2,431,350	Commercial Cable, Stlng. 600 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	90 — 92	90½	..	+1	4 7 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼ — 8⅞	8⅛ — 9	..	..	+ ⅛	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	5 8 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅜ — 8¾	8⅜ — 8¾	..	..	..	5 12 8
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	8 16 8
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜ — 13⅛	12⅞ — 13⅜	13	13⅛	..	6 13 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	125 —128	126 —129	127½	126	+1	5 8 6
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	84½— 86½	84½— 86½	84½	84⅜	..	4 0 0
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	105	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½ — 12	11⅞ — 12	11⅞	11½	..	5 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104 xd	102 —104	102½	102	..	3 16 11
230,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	10 1/4	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½— 10⅞	10½— 10⅞	10 9/16	10½	..	5 7 0
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½— 13⅞	13½— 14	13⅞	13⅝	+ ⅛	4 5 9
160,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26½ — 27½	26¾	26½	+ ¼	6 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½ — 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	74 — 79	74 — 79	..	..	..	5 5 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	16/-	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅛ — ⅜	⅛ — ⅜	..	..	..	6 0 7
96,492	Do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	5 13 8
2,235,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106 — 107½	106⅝	106	..	5 11 7
8,735,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122½—124½	123 —125	123¼	122½	+ ½	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5¼ — 5⅜	5 7/16 — 5 1/2	5½	5 7/16	—⅛	4 7 8
9,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 — 100	98 — 100	98½	98	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
179,813	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	28/1½	28/-	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 3 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85½ — 87½	85 — 87	85	..	— ½	4 12 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 — 101	99 —101	..	..	..	3 19 3
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	7⅞	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —132	130 —133	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5½	5⅜ — 5½	..	..	..	4 10 8
80,008	W. Coast of America, 1 to 80,000 & 55,001 to 58,008	2½	Nil	2½%	2½%	..	1¼ — 1⅜	1¼ — 1⅜	22/6	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
307,980	Western Telegraph, Ltd., Nos. 1 to 307,980.. ..	10	7 %	7 %	7 %	..	13½— 14	13⅜ — 14	13⅜	13⅛	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102⅛—104½	102⅛—104½	..	..	..	3 16 7
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	6 %	6 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	17 2 4
80,001 ‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

350,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 350,007	5	8 %	8 %	9 %	10 %	9 5/16 — 9 9/16	9 5/16 — 9 9/16	9 11/32	9 7/16	..	5 5 3
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	90½ — 91½	90⅜ — 91⅜	91⅜	91¼	..	4 6 6
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
650,000	Babcock & Wilcox, 1 to 650,000..	1	20 %	20 %	20 %	20 %	4½ — 4⅝	4 5/16 — 6 7/8	87/6	86/3	+ 1/16	4 9 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2 — 2	2 — 2	..	..	..	48 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1½ — 1⅝	1⅝ — 1⅞	..	..	+ ⅛	18 13 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3 — 3½	3 — 3½	..	..	..	8 11 5
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2½ — 3½	2½ — 3½	..	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	93 — 96	93 — 96	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —148	144 —148	147	..	..	5 8 1
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	119 —123 xd	121 —125	123	122½	+2	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	..	..	..	4 10 11
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	102½	..	..	4 6 7
488,801	British Electric Traction	10	3 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1¾%	2 — 2½	2 — 2½	..	..	..	6 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	86 — 90	85 — 88	86½	..	—1½	5 16 3
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	64 — 68	63 — 67	..	..	—1	6 14 4
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅜ — 7¾	7⅜ — 7⅝	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6½	6⅜ — 6½	6 5/8	..	..	4 11 3
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 — 106	..	..	..	4 4 11
804,941	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
1,816,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	3/16 — ¼	3/16 — ¼	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 8
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 4⅝	4½ — 4⅝	97/6	..	..	4 12 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 39,380..	5	5 %	5 %	5 %	5 %	4⅝ — 5	4⅝ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅜	10 — 10⅜	10⅜	10⅛	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5½ — 5⅝	..	..	..	4 13 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104⅛—106⅛	104⅛—106⅛	..	..	..	4 4 6
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	1⅝ — 2	1⅝ — 2	39/3	39/-	..	6 0 0
210,188	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	104 —107	104 —107	..	..	..	3 14 9
1,890,690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	60 — 62	62 — 64	64	61	+2	5 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,000,000	City and South London Railway	Stock	3½%	3½%	3½%	3½%	31 — 33	31 — 33	31½	31	..	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	3½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued).

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	Closing Quotations Aug. 3rd.	Closing Quotations Aug. 10th.	Business done week ended Aug. 10th. 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
£		*									£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	1 7/16 — 1 1/2	1 7/16 — 1 1/2	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	1 31/32 — 2	1 31/32 — 2	..	..	..	4 16 0
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin Electric Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 7 3
99,361	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,361	5	2½%	2½%	..	3/8 — 1/2	3/8 — 1/2	..	..	..	25 0 0
17,189	Do. "A" shares, 01—017,189	5	2½%	2½%	..	1/2 — 3/4	1/2 — 3/4	..	..	..	..
207,895	Do. 4 % Deb. Stock Red.	5	2½%	2½%	..	1 1/4 — 2 1/4	1 — 1 1/2	..	..	— 1/2	8 6 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
112,100	Electric Construction, 1 to 112,100	100	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 12 4
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390	2	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	2	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/16	26/10½	..	..	9 13 1
200,000	Do. do 4 % Mort Deb.	10	5 %	5 %	5 %	7 1/2 — 8	7 1/2 — 8	..	..	..	6 5 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	Stock	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	4 %	4 %	Nil	3/4 — 1	3/4 — 1	..	..	..	6 13 4
82,000	Do. do. 5 % Mort. Debs.	10	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 10 3
46,000	Hanley's (W. T.), Telegraph Works, Ord.	100	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Do. do. 4½ % Pref.	5	15%	15 %	15%	12½ — 13½	12½ — 13	12 5/8	..	+ 1/4	7 2 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	5 1/8 — 5 1/2	5 1/8 — 5 1/2	..	..	..	4 1 10
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	105½ —107½	105½ —107½	..	..	..	4 3 9
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	Nil	14½ — 15½	14½ — 15½	15½	15	..	6 11 2
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	3/8 — 7/8	3/8 — 7/8	..	..	..	Nil
600,070	London United Trams. (1901), 1 to 60,007	10	5 %	5 %	5 %	5 — 6	4½ — 5	..	..	—½	10 0 0
299,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1/4 — 1/2	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	3 %	3 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
1,981,000	Do. do. 4 % 1st Mort. Deb. Stock	10	5 %	5 %	5 %	2 — 2½	2 — 2½	45/-	..	..	15 0 0
5,782,063	Metropolitan Consolidated	100	4 %	4 %	4 %	68 — 71	68 — 71	68½	..	..	5 12 8
2,640,914	Do. Surplus Lands	100	3½%	1 %	1 %	40½ — 40¾	40 — 40½	40 ½	40	— ¼	1 4 6
8,385,000	Do. District	100	2½%	2½%	2½%	65 — 67	65 — 67	65	..	..	4 2 1
391,337	Metropolitan Electric Trams., Ord.	100	Nil	Nil	Nil	17½ — 17¾	17½ — 17¾	17½	17⅜	..	Nil
814,016	Do. do. Defd.	1	..	..	..	3/8 — 1/2	3/8 — 1/2	..	..	..	..
600,000	Do. do. 5 % Cum. Pref.	1	Nil	Nil	Nil	1/8 — 3/16	1/8 — 3/16	..	..	..	Nil
595,600	Do. do. 4½ % Deb. Stock Red.	1	5 %	5 %	5 %	3/8 — 1/2	3/8 — 7/16	..	..	..	5 19 5
$16,823,200	Mexico Trams Co., Common Stock	100	4½%	4½%	4½%	95 — 97	95 — 97	9½	..	..	4 12 9
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	128 —126	124½ —127½	127½	125½	+1½	..
245,500	Potteries Electric Traction	5	5 %	5 %	Nil	98 — 95	94½ — 96½	9½	93½	+1½	5 5 3
245,500	Do. 5 % Cum. Pref.	1	4 %	4 %	4 %	1/8 — 1/4	1/8 — 1/4	..	..	..	..
245,000	Do. 4½ % Deb. Stock	100	5 %	5 %	5 %	1/8 — 1/4	1/8 — 1/4	12/3	..	..	6 17 11
87,850	Telegraph Construction and Maintenance	12	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	15 %	15 %	17½%	34 — 35½	34½ — 36	35½	35	..	2 10 9
1,000,000	Underground Electric Railway, 5% Prior Lien	..	4 %	4 %	4 %	99½—101½	100 —101½	..	..	+ ½	3 18 10
2,800,000	Do. do. 4½% Bonds	..	..	..	5 %	102½—103½	102½—103½	..	..	..	4 16 7
4,900,000	Do. do. 6% Income Bonds	..	..	..	4½%	87 — 89	87 — 89	88¾	..	..	5 1 2
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	36 — 38	35 — 37	37½	36½	—1	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	3/8 — 7/8	3/8 — 3/4	..	..	..	..
245,495	Do. % 1st Mort. Deb. Stock	..	4 %	4 %	4 %	2⅜ — 3⅛	2⅜ — 3⅛	58/6	..	..	1 18 5
						76 — 80	76 — 80	78¼	78⅜	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	..	5½%	5½%	5½%	5½%	4¼ — 4⅝	4¼ — 4⅝	..	..	..	5 10 6
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8 — 8½	8 — 8½	8 1/16	8⅛	..	5 17 8
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
236,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	88/9	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	..	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	8½ — 4⅝	8½ — 4⅝	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞ xd	10⅞ — 10⅞	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12⅝ xd	12 1/16	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	102	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 2½	..	..	..	..	8 6 8
80,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3⅛ — 3⅜	3 — 3½	..	..	— ⅛	7 2 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93⅝ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛ xd	7⅝ — 8⅛	8	..	— ⅛	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11	10⅝ — 11	10⅝	10 3/8	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	108 —106	105 —106	105½	10	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101½	100	..	4 7 5
60,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	1/8 — 1/4	1/8 — 1/4	..	..	— 1/32	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	1/8 — 1/4	7/6	..	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	58 — 61	59	..	..	7 7 7
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	84½ — 86½	84½ — 86½	86⅝	85½	..	5 16 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	6 7 4
10,000	Do. 6 % Cum. Pref., 1 to 10,000	5	6 %	6 %	6 %	6 %	5 — 5⅜	5 — 5⅜	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	97½—100½	98 —101	99	..	+ ½	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	6¾ — 7⅛	6⅞ — 7⅛	..	..	— ⅛	5 12 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	96 — 98	98⅜	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	4 16 0
70,000	Do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	5 11 8
282,553	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4⅞	4⅜ — 4⅞	92/6	..	..	5 5 3
75,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	5	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
348,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	83 — 85	84½	83⅜	+1	5 17 8
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	65 — 69	70 — 74	72	69	+5	4 14 7
$3,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	105 —109	109	107½	+1	6 8 5
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85½ — 87½	85 — 87	86⅜	85½	— ⅛	5 14 11
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	91 — 97	..	..	..	4 12 9
120,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	2 10 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 0 0
196,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,863	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11⅛ — 12⅛	11 — 12	..	..	— ⅛	5 16 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,294	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	5 7 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	5 8 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½ — 9	8⅝ — 9	..	..	..	7 2 10
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 11 10
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1/8 — 1/4	..	..	..	..	Nil
95,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜ — 3⅛	2⅜ — 3	..	..	— ⅛	6 13 4
125,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/8 — 3/16	1/8 — 1/8	..	..	..	4 8 11
142,962	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	5 6 8
224,590	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—104	100 —103	..	..	..	4 6 7
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	95 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅜ — 2⅛	1⅜ — 2	..	..	— ⅛	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	76 — 80	76 — 80	..	..	..	5 12 6
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	7/16 — 1/2	7/16 — 1/2	18/1½	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	..	12 %	12 %	10 %	10 %	8⅝ — 9⅛	8⅝ — 9⅛	9⅛	..	+ ½	5 8 1
81,370	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1908)	5	5 %	4½%	4½%	4½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

REVIEWS.

Theory and Calculation of Transient Electric Phenomena and Oscillations. By C. P. Steinmetz. New York: McGraw Publishing Co. 1909. Price $5.

Prof. Steinmetz gave a course of instruction for a number of years to the Senior Class in Electrical Engineering at Union University. This book is founded on his lectures.

A careful perusal of it has convinced us that it will be of great value for many years to come as a storehouse of information, to which the mathematician will come when he wants to discover the physical meaning of his equations, and to which the electrician will have recourse when he wants to find out the reason of puzzling phenomena. It will also prove of particular value to that most deserving individual, the serious student, who wants to do real work in the world, and not to be a mere machine performing by rote operations which must to the half-educated mind appear similar to the rites of astrologers.

The book is divided into four sections. The first, which is entitled "Transient Phenomena in Time," discusses phenomena similar to those of the rise of currents in circuits containing capacity and inductance. "Periodic Transient Phenomena" are considered in the second section. Such phenomena occur in various types of interrupters, such as the one devised by B. Cohen, and in various types of rectifiers, such as the Ferranti and the mercury-arc rectifier. In the third section—"Transient Phenomena in Space"—problems which occur in long-distance transmission and in iron when subjected to alternating magnetising forces are discussed. The theory given illumines the whole subject, showing a clear picture of the actual transition stages. Several of the problems in the last and most difficult section, entitled "Transient Phenomena in Time and Space," have been previously considered by Dr. Oliver Heaviside, more particularly those in connection with the reflection of waves, but the author's method of discussing standing waves and free oscillations in long transmission lines is original and instructive.

Each of the sections is almost complete in itself. This leads to a certain amount of repetition, but will probably be advantageous to most readers. In our opinion, a serious drawback to the book is the practically complete absence of references to other books and papers, which seriously discounts the book from the teaching point of view. A highly original work like that under review is of far greater value than a mere compilation of undigested papers, no matter how valuable the individual papers may be, but there are many places in this book where a line or two giving the necessary references seems almost indispensable. Where the author can give an experimental justification of his theorem references, although sometimes desirable, are not essential, but when he enters into almost metaphysical calculations, we lose confidence unless we can find out how he obtains his figures. For example, on page 73 an oscillating circuit consisting of two spheres each 0·45 in. in diameter, and separated by a 0·3 in. gap, is considered. It is stated that the capacity of the spheres against each other (this is the first time we have ever come across this phrase) is the hundred millionth of a microfarad. No reference is given, and so a large, and, in our opinion, a quite uncalled-for demand is made on the reader's credulity. Formulæ for this case have been worked out by such well-known physicists as Kelvin and Kirchhoff; a reference to either of these would suffice. Possibly it would have been better to give a reference to the much more easily computed formulæ due to the writer of this review.

The definitions of inductance and capacity given on pages 9 and 11 are a little far-fetched, and must be regarded as shibboleths by the student. A brief *résumé* of some of the formulæ recently examined by the able mathematicians at the Bureau of Standards would help to remove this impression. On page 11 the electric strength of air is given as 60,000 volts per centimetre. This number is certainly not correct for large electrodes, and is not in accordance with our reading of the valuable experimental results obtained by the author and published a good many years ago.

The empirical formula given by Fröhlich in 1882 (one of the few historical references given in the book) for the connection between flux and magnetising force is stated to give a parabolic curve. This is a slip, as a hyperbolic curve is meant. In the first section an exceedingly interesting series of curves is given, illustrating excellently the initial disturbances which ensue when a circuit is switched on suddenly to the alternating-current supply mains. The ordinary author avoids the labour involved in these calculations. As there is nothing startlingly new to be found out, he contents himself with giving more or less vague word pictures of what happens. Here we see the actual phenomena at a glance. Pictures such as those given would have saved the reviewer weeks of hard thinking many years ago.

On page 68, lines 10 and 11 from the foot of the page, occurs one of the very few slips in the book—five joules is given instead of 50, and a "hundredth" is given instead of a "tenth." On page 124 the sign "=" is omitted from equation (21). On page 136 it should be stated that $a = 0{\cdot}1$ is the exact root of the cubic equation. We had started to find a closer approximation by Newton's method before we found this out. On page 144 a discussion is given of the currents in circuits containing resistance, inductance and mutual inductance. We were surprised to find that the exceedingly interesting and important case when

$$\frac{L_1 - M}{R_1} = \frac{L_2 - M}{R_2}$$

is not considered.

The last two chapters of the first section discuss the transient term of the rotating field and the short-circuit current of alternators. They are both of considerable practical importance, and contain much novel matter.

Perhaps the most important subject discussed in the second part is arc rectification. A masterly analysis has been given, and the agreement between the theoretical and the actual shapes will convince electricians—if any real electricians need convincing nowadays—of the practical value of mathematics in engineering. This subject Prof. Steinmetz has made peculiarly his own, and he is to be congratulated heartily on his able contribution to the world's knowledge.

The third section is, perhaps, not quite as good as the second. We think that an account of some of Prof. Kennelly's work would have been appreciated by the reader. On page 279 the velocity of light is stated to be 188,000 miles per second; if we remember correctly, Prof. Rosa's experiments make it 186,200 miles per second, and they are practically in agreement with the latest astronomical results. In the formula for the natural period of the line given on the next page there is no mention that the resistance of the line is neglected. The author gives the complete and correct expressions later on, but it would have been better to point out the limitations earlier.

The following extract, page 339, is very instructive:—"A long-distance transmission line has a definite natural period of oscillation, of a relatively low fundamental frequency, and its overtones, but can also oscillate with any frequency whatever, provided that this frequency is very high.

"This is analogous to waves formed in a body of water of regular shape; large standing waves have a definite wave length, depending on the dimensions of the body of water, but very short waves, ripples in the water, can have any wave length, and do not depend on the size of the body of water."

We appreciate very highly the author's formula for the self-inductance of an antenna. We think it a pity, however, that the results were not given in terms of "sine" and "cosine" integrals, the values of which are tabulated in several books (*vide* "Dale's Mathematical Tables," page 85). The new *sil* and *col* functions of the author can be put at once in terms of these, and are, therefore, unnecessary. The formulæ also would be in many places greatly simplified by introducing hyperbolic sines and cosines, which are now well known to engineers, and many tables of which are readily available. We like the author's method of calculating the power radiated into space. This will be of great importance in wireless work.

On page 405, l is written for l_0 in formula (4). Mentioning

this trifle shows how carefully the proof readers have done their work, but in our opinion the wording could easily have been improved in many places. On page 406 we take it that the "thermal" resistance is the same as the "ohmic" resistance. On page 413 tables are given to show the increase in the effective resistance due to the skin effect. We notice that figures for a wrought-iron pipe are given, and we wonder whether the correct formula originally given by Heaviside, and independently verified by the reviewer, was used in the calculation. If not, this table will need to be altered.

The last section is very good, but the formulæ need very careful consideration. There is one minor statement on page 446 which we think needs amending. It is stated that the velocity of light is $1/\sqrt{LK}$. This is certainly true for two parallel wires, provided their resistivity is negligible. In this case $\sqrt{LK} = \sqrt{\lambda\mu}$ where λ is the conductivity and μ the permeability of both the metal and the air. Hence the velocity of light in this case at least is always equal to $1/\sqrt{\lambda\mu}$, and the limitation that both are unity is unnecessary.

Engineers cannot have a better guide than Prof. Steinmetz. His engineering intuition and experience enable him to surmount mathematical difficulties which would prove insuperable to the mathematician with no extraneous guides to help him. This book opens a new chapter in engineering.

A. R.

High-Speed Dynamo-Electric Machinery. By H. M. Hobart and A. G. Ellis. London: Chapman & Hall. Price 25s. 6d. net.

This work deals with the design of generators for coupling to turbines. An important point which the authors make in their introductory chapter is that when designing a machine for a given output, the higher the speed adopted the smaller and therefore less costly the machine; further, that as the speed is increased, we finally arrive at a speed at which, owing to mechanical and other difficulties, the cost begins to rise again, so that for any given output there is a certain economic speed, and this speed is lower for continuous-current machines than for alternators. This question of the economic speed is one which the authors keep before them throughout the book.

In the second chapter the coefficients of output, weight and cost are treated. These coefficients are useful as a basis from which to start a design, and most designers now make a point of having a good collection of them.

In the formula for the output coefficient, which is based on the linear dimensions and speed of the machine, the authors introduce two new values, α = the ampere conductors per unit of length of armature periphery, and β = the average magnetic flux density in the air-gap.

The weight and cost coefficients are taken on the gross length of armature and the square of its diameter, and are principally useful for making rough comparisons, and possibly rough preliminary estimates of weight and cost.

In the third chapter four methods are given for estimating the temperature rise of machines, the results of the four methods being plotted as curves. These curves seem a little discordant, and it would be an advantage if the authors could see their way to supplement them with some experimental figures.

Chapter IV deals with materials, their magnetic and electric qualities, relative cost and mechanical strength, the latter an important point in high-speed electrical machinery, in which the centrifugal forces are so considerable.

The first four chapters form Part I of the book. In Part II the design of alternators is dealt with, the authors, for the sake of variety, departing from the usual custom of taking continuous-current machines first. In this portion of the book each detail of design receives the authors' usual thorough treatment, and complete tabulated figures are given of several designs. The mechanical stresses in rotating field systems due to the centrifugal forces receive a chapter to themselves.

Part III treats in an equally thorough manner the design of continuous-current machines. Owing to the difficulty of designing continuous-current generators of very high speed for large outputs, the authors propose a direct-current generating plant, in which a turbo-alternator supplies current to a rotary converter, which supplies the circuit with direct current of the required voltage.

In the final chapter brushes and brush-holders are treated, and the respective merits of carbon and copper brushes are discussed. This is a subject in which interest is beginning to be aroused, and it is not at all improbable that in the near future a return will be made to metal brushes in some form.

This book having apparently been written in the first place for American readers, the units of money are in dollars, and the metrical system of measurement is used. The value of the book to English readers would be somewhat enhanced if, in another edition, the measurements and quantities were given in English units also.

Electric Lamps. By Maurice Solomon. London: A. Constable & Co. Price 6s. net.

Mr. Solomon explains in the preface that he has been engaged in the manufacture of, first, Nernst lamps, then carbon-filament lamps, and finally, after a brief digression into tungsten filaments, arc lamp carbons, so it is evident that he is well qualified, as far as experience goes, to write this book.

The first chapter discusses the aims and objects of illumination. The second, entitled "The Production of Artificial Light," treats of such interesting things as black-body radiation, emissivity and selective radiation.

Chapter III is entitled "Photometry." The laws governing photometric measurements are very clearly explained, and a few typical photometer heads are described. We note that the flicker head is objected to, on the ground that it has not yet been proved to measure equality of illumination.

Chapter IV—"Methods of Testing"—discusses distribution curves, mean spherical candle-power, and so on. The unfairness of comparisons based on mean horizontal candle-power only is insisted upon, even for lamps of the same class, as their reduction factors frequently vary during life.

The fifth chapter describes the process of manufacture of carbon-filament lamps; the sixth chapter treats of Nernst lamps, and the seventh of metal-filament lamps.

Chapter VIII is entitled "The Electric Arc," and is mostly a clearly expressed *résumé* of Mrs. Ayrton's historical researches. The next chapter, on "Arc Lamp Carbons," is well written, and includes some very interesting tests and comparisons.

Chapter X is about arc lamps, and Chapter XI briefly touches upon the magnetite arc, mercury-vapour lamps, and the Moore tube light.

Finally, a chapter is devoted to discussing the relative merits of different types of lamp, especially with regard to cost of operation.

Verdict: A mostly interesting book, clearly expressed, and written by one evidently familiar with his subject.

ELECTRIC LAMP TAXATION IN GERMANY

The German Parliament has now approved the new taxes on electric lamps and gas mantles, which will come into operation at the commencement of October. It is estimated that this new source of taxation, of which details are given below, will yield an annual income of £1,000,000.

Scale of Taxes on Lamps.

Consumption.	Carbon-filament lamps.	Metallic-filament lamps, Nernst burners and other glow lamps.
	d.	s. d.
1. Up to 15 watts	$\frac{5}{8}$	0 $1\frac{1}{4}$
2. Over 15 watts to 25 watts ...	$1\frac{1}{4}$	0 $2\frac{1}{2}$
3. „ 25 „ 60 „ ...	$2\frac{1}{2}$	0 4 8
4. „ 60 „ 100 „ ...	$3\frac{3}{4}$	0 $7\frac{1}{4}$
5. „ 100 „ 200 „ ...	6	1 0

Carbon-filament lamps which have a higher consumption than 200 watts are subject to an additional tax of 3d. each for each further 100 watts or portion thereof, and metallic-filament lamps, Nernst burners, &c., are liable to a further impost of 4·8d. per lamp for each further 100 watts or portion thereof. The tax on mantles for incandescent gas lighting is $1\frac{1}{2}$d. each.

The tax on pure carbons for arc lamps is 7·2d. per kilogram, and 1s. per kilogram for carbons made of carbon with illuminating admixtures or other carbons. Burners for mercury-vapour and similar lamps up to 100 watts are to be taxed at 1s. each, with an addition of 1s. per lamp for each further 100 watts or portion thereof.

The tax is to be paid by the manufacturer by the employment of revenue labels on the packages, before the finished and packed products are removed from the rooms of the place of production. In the case of imported articles, the tax has to be paid by the importer on clearing the Customs House, or, if this does not take place, it has to be paid within a period of three days after reception. The Federal Council will make detailed regulations respecting the amounts of the value of the revenue labels, their shape, style, sale and the method of their use. The council will determine the conditions under which compensation is to be allowed in regard to the amount of taxes paid in the case of revenue labels which have become unuseable; and labels which are not used in the prescribed manner will be regarded as not used. The employment of revenue labels is not requisite if the taxable articles are notified for export under official supervision before removal from the rooms of the place of production. The payment of the tax can be postponed for three months without guarantee, but it can be deferred for six months when a guarantee is given. Stock under a revenue seal can be considered as security.

The manufacturer will receive compensation for the taxes in the case of articles which are placed at his disposal by the recipient as being unserviceable. This can be granted in a lump sum, which will be calculated according to the taxation value of the revenue labels used by the manufacturer in the course of the year.

Articles liable to taxation are only allowed to be placed on the inland open market from the producing establishments and from abroad when they are contained in completely closed packages, which cannot be opened without indications that can be recognised. Packing according to regulations has to take place before admission to liability to taxation, and is considered as a part of the manufacture. The Federal Council will determine the method of packing and the size of the admissible packages, on each of which the contents are to be stated. In the case of incandescent electric lamps and mercury-vapour and similar lamps, the package is to indicate the number contained and the consumption in watts; in that of gas mantles, the number; and in that of arc lamp carbons, the weight of the carbons, their respective classes, whether pure carbon or carbon with illuminating admixtures, together with the designation of the packed articles (trade mark) and a denotation from which the revenue authorities can determine with certainty the person liable to taxation. In the case of imports, the packing can be permitted to take place inland under special measures of security. The Federal Council is empowered to take special measures of security in regard to the retail trade of taxable articles.

The question of exemption from compulsory packing is vested in the Federal Council. It is provided, for instance, that in the case of its being proved to be required, the council can release the manufacturer from the compulsory packing and the use of revenue labels on the basis of special book-keeping and the otherwise requisite measures of security. Imports which are not intended to be placed on the market can also be exempted from the use of revenue labels and compulsory packing.

The revenue labels are to be kept intact on the packages until the latter are required to be opened for retail sale or are handed to the purchaser. Opened or wholly or partly emptied packages are not allowed to be filled again with taxable articles. The retail sale is only permitted to take place with or out of the accessory wrappers. Empty wrappers, without previous removal of the revenue labels, are not allowed to be returned either to manufacturers or merchants, nor to be accepted or used again by the latter. Dealers who receive articles which are not packed in the prescribed manner, or which are not designated or provided with revenue labels, have to make a report to the revenue authorities within three days.

ARBITRATION OR LITIGATION?

[BY A LEGAL CONTRIBUTOR.]

THE Arbitration Act of 1889 has been in force for over 20 years. Dissatisfied with the tedious delays occasioned by having recourse to the recognised tribunals of the land, commercial men sought for some tribunal, recognised by law, in which the numerous disputes arising in trade could be determined with the least possible delay and expenditure, and with impartial justice to all concerned; and in answer to this appeal the Legislature passed an Act which recognises the Court of Arbitration as a tribunal of which the decrees can be enforced. It is true that thousands of arbitrations take place in the course of the year, to the satisfaction of the parties interested therein; and it is also true that time and money are saved by recourse to the tribunals. But a glance at the law reports is sufficient to show, in the first place, that courts of arbitration often lack that "finality of decision" so essential to every court of justice; and in cases where the arbitrator's decision must be regarded as final, and incapable of being reopened by the party who thinks himself aggrieved, serious injustice is sometimes done.

The statute to which allusion has already been made was passed in order to reduce these evils as much as possible. Ordained to enable the parties to a commercial contract to have recourse to their own domestic forum, it gives power to any judge of the High Court to stay any action brought before him which has for its object the settlement of a dispute which should be submitted to arbitration. In this roundabout way the parties are compelled to seek justice, or, at any rate, a decision upon the questions at issue at the hands of their self-appointed judges.

It is easy, of course, to criticise the reference of matters to arbitration, and to suggest that parties are better advised to go to law; but cases are sometimes referred to arbitration without the consent of the parties. Thus, if a case which is coming before the courts in the ordinary way involves matters of long and complicated scientific inquiry, the Judge will refer it either to an Official Referee or else to arbitration, without the consent of the parties. We propose, however, in this article to confine ourselves to those cases in which arbitration is voluntarily resorted to by the parties.

One would have thought that the primary objects of an Arbitration Act should be (*a*) to render the decision of an arbitrator final, except in cases of obvious injustice; (*b*) to compel parties to have recourse to their agreed tribunal, however constituted. Certain recent cases, which it is proposed to consider, show that unless the parties give close attention to the wording of the submission clause in their agreement, one or other of them may find his right to call for arbitration defeated at a critical moment.

A party to an arbitration—or, at any rate, the party against whom the award is made—sometimes forgets that by fleeing from a court of justice to a tribunal of his own, he well-nigh forfeits all right of appeal. It is some consolation to a disappointed litigant that he can proceed to a higher court; the first reflection of a defeated party in an arbitration is that he is stopped from carrying his case any further.

"In references by consent the general rule is that, as the parties choose their own arbitrator to be the judge in the disputes between them, they cannot, when the award is good on its face, object to his decision, either upon law or the facts." Such is the conclusion arrived at by a learned text-book writer upon the law of arbitrations and awards. Let us consider a few cases which illustrate the hardships inflicted by the rigorous enforcement of this doctrine.

In a case which was heard in 1847, the plaintiff sued for the price of goods sold and delivered. The defendant pleaded the Statute of Limitations, which, as is well known, prevents a claim of this kind being made after six years have elapsed. The arbitrator refused to abide by the law of the land. He decided in favour of the plaintiff for the full amount, and the Court declined to disturb his finding, apparently because the mistake was not manifest on the face of the award.

In cases where disputes are referred to one arbitrator, as distinguished from those in which the tribunal consists of two or more members, a man voluntarily places his interests in the hands of one man, who may or may not be biased, and a mere suspicion that an arbitrator is biased does not invalidate the award. It not infrequently happens that disputes between building owner and builder are referred to the architect; while, to take a more pointed case, questions arising between a railway company and a contractor are often determined by the company's engineer. Far be it from us to suggest that any engineer of standing would allow his natural leaning towards his employers to affect his better judgment; but still there is an element of risk, which the contractor is almost compelled to undergo. To consider an instance: We recollect a case in which an agreement between a company and a contractor contained the ordinary clause, that any dispute should be referred to the decision of the company's engineer. A dispute arose, and the engineer, in a letter to the contractor, expressed an opinion upon it. The company proceeded to arbitration, appointing the engineer as arbitrator in accordance with the submission. The contractor brought an action. Mr. Justice Kekewich restrained the arbitration, on the ground that the arbitrator had committed himself beforehand, and had not kept an open mind. The Court of Appeal, however, discharged the injunction, and ordered the arbitration to proceed, on the ground that the engineer had only expressed his opinion as engineer, and that as the contractor had submitted by his contract to refer all disputes to the engineer, who would necessarily have to express his opinion on disputes as they arose, he must abide by his contract.

In fact, as the law at present stands, in order to upset an agreement to refer to an arbitrator who, from his position, is necessarily interested, the party must attack the character of the arbitrator to the extent of showing that he will not act fairly; and it has been decided that the mere fact that he will have to adjudicate on his own or his son's professional conduct is not sufficient to upset the agreement to refer matters to arbitration.

It cannot be denied, however, that the Courts always endeavour, as far as possible, to see that the spirit as well as the letter of an arbitration clause is attended to by the parties. Thus a policy of insurance contained a clause which empowered the insurance company to nominate an arbitrator. They nominated their own manager. The Court held that such a proposal was monstrous, and gave them seven days to appoint another arbitrator, or in default ordered rescission of the submission.

Seeing that submission of all disputes to the arbitrament of one individual is open to these grave objections, business men are wont to select a tribunal of three, two of whom are appointed by the parties, and the third by the two so appointed. Whether the two arbitrators so appointed act as advocates or not, detracts but little from the efficiency of a court so formed; for the third member, who is appointed by persons who have but an indirect interest in the dispute, will generally be quite impartial.

But what recognition has the Arbitration Act of 1889 conferred upon a tribunal of this kind? The answer to this question, which affects the construction of a clause in nearly every charter party, serves to show that, to use the language of Lord Justice Lindley, there is a serious blot in the Act.

In order to understand the way in which the Arbitration Act is defective in this particular, it is necessary to go back a step or two. Arbitration clauses refer disputes either (*a*) to a single arbitrator; or (*b*) to two arbitrators to be selected by the parties, the arbitrators appointed having power to appoint an umpire in case of disagreement; or (*c*) to three arbitrators, the third of whom is appointed by the first two, who are themselves nominated by the parties.

The Arbitration Act of 1889 (by Sub-secs. 5 and 6), makes provision for cases in which the parties fail to agree upon an arbitrator, or in which one or other of them refuses to appoint his arbitrator. In such cases the party willing to proceed to arbitration may, after certain formalities, himself make the appointment; but, by an extraordinary omission, no mention is made of a Court consisting of three arbitrators. What must happen, supposing one party to an agreement of this kind fails to make an appointment? The discussion of this point in a recent case discloses a serious defect in the Arbitration Act of 1889; a defect, moreover, which practically renders ineffectual every arbitration clause now in existence, which refers disputes to three arbitrators. To introduce this point in an intelligible manner, it is necessary to refer to a case which was heard in 1890.

A charter party contained the following clause:—"Should any dispute arise between the owners and the charterers, the matters in dispute shall be referred to three persons, one to be appointed by each of the parties hereto, and the third by the two so chosen; whose decision, or that of any two of them, shall be final; and for the purpose of enforcing any award, this agreement may be made a rule of Court." The Arbitration Act was in force at the time. A dispute having arisen, the shipowners gave notice to the charterers that they had appointed an arbitrator, and called upon them to appoint one also; but the charterers took no notice, and appointed no arbitrator. The shipowners applied for and obtained an order that the charters should appoint an arbitrator upon the terms of the submission, and this order was upheld by the Divisional Court. The charterers appealed. The Court of Appeal, consisting of Lords Esher, M.R., Lindley and Bowen, L.JJ., came to the unanimous conclusion that they had no power to direct either party to appoint an arbitrator, and that the fact of the submission being made a rule of Court had no bearing upon the question. They also decided that Sub-secs. 5 and 6 of the Arbitration Act, 1889, had no application to a reference to "three arbitrators as distinguished from two arbitrators and an umpire." Upon this point Lord Justice Lindley said: "It certainly looks like a blot in the Act that, by reason of there being no provision as to three arbitrators as distinguished from two arbitrators, the submission should be irrevocable."

The following conclusions can be drawn from the above case:—(1) The Court has no power, whether by virtue of the Arbitration Act or otherwise, to order either party to appoint an arbitrator. (2) That the Arbitration Act, 1889, had no application to a tribunal consisting of three arbitrators. (3) In a case where three arbitrators are to be employed, the only remedy against a party who refuses to appoint an arbitrator is an action for breach of agreement.

Whatever other theoretical conclusions may be drawn from this case, its practical result was that the Court refused to enforce the settlement of disputes by arbitration, and the shipowners were told that they might sue for the breach of agreement to arbitrate. It would be interesting to see what damages would be awarded in such a case, and more interesting still to be informed upon what basis they would be calculated.

Until quite recently the above case has merely been regarded as a satisfactory authority for the proposition that the Court has no jurisdiction to compel either party to appoint an arbitrator. It has also been quoted in support of the statement that a reference to three arbitrators is without the pale of the Arbitration Act, 1889. A case which was decided in the summer of this year throws more light on the question. An action was brought by shipowners against charterers for freight alleged to be due under the terms of a charter party. The charter party contained an arbitration clause couched in precisely similar terms to those under discussion in the former case. On the application of the defendants, who were ready and willing to appoint their arbitrator, and proceed to arbitration in accordance with the terms of the submission, Mr. Justice Bigham made an order under Sec. 4 of the Arbitration Act, 1889, staying the action. The shipowners appealed to the Court of Appeal (A. L. Smith and Vaughan-Williams, L.J.J.). After dealing with the case mentioned above, and having pointed out that it only decided that the Court had no power to compel a party to a submission to appoint an arbitrator, Lord Justice A. L. Smith, in alluding to Sec. 4, said:—"There is nothing in the words of this section to show that the section does not apply to a submission to arbitration in which there are to be three arbitrators. Nor is there anything in the definition of "submission" which is given in Sec. 27 of the Act to lead to such a conclusion. The present case seems to me to fall exactly within the provision of Sec. 4, and the learned Judge had jurisdiction to make the order against which the plaintiffs are now appealing." Lord Justice Vaughan-Williams concurred, and the appeal was dismissed.

There is no reason to doubt that the above decision was correct, for a submission within the Arbitration Act means "a written agreement to submit present or future differences to arbitration, whether an arbitrator is named therein or not." But what an extraordinary state of things results from placing the decision in this case side by side with that in the first case! The question whether a reference to three arbitrators shall or shall not be enforced depends entirely upon the taste and fancy of one of the parties to the agreement. If he is of opinion that an action-at-law would better suit his purpose, he may refuse to appoint an arbitrator, and the Court has no power to compel him to do so; while his opponent, anxious to proceed to arbitration in accordance with his agreement, cannot do so, but is compelled to issue his writ in a Court which it was his original purpose to avoid.

City men have been driven to arbitration by the law's delays and by dread of the technicalities with which the wheels of legal machinery are said to be clogged. Here was a statute which purported to establish tribunals unhampered by technical rules, to which both parties might be compelled to proceed. It now appears that no party to an agreement can be compelled to have recourse to a tribunal which, upon the face of it, appears to be the most satisfactory of all, and to which, moreover, he has solemnly agreed to go. Surely this is a serious blot in the Arbitration Act of 1889.

This anomaly becomes all the more absurd when it is pointed out that a reference to two arbitrators and an umpire will be enforced by the Courts. This tribunal, which is referred to in the schedule to the Arbitration Act, is unsatisfactory in the extreme. The schedule says:—"If the reference is to two arbitrators, they may appoint an umpire at any time within the period during which they have power to make an award." Surely the method of procedure here prescribed is not well calculated to bring about the appointment of an open-minded Court. Arbitrators named by the parties often seem to think, notwithstanding the objectionable nature of such a course, that they are to represent their respective nominators, and act rather as advocates than judges; while the umpire assumes that his active interference is not to commence until the others have differed finally. References of this sort have been strongly condemned by the judges themselves as "being senseless and mischievous, founded on a totally wrong principle, expensive in their operations, and constantly ending in failure and disappointment." On the other hand, upon a reference to three or more arbitrators together, when there is no clause providing for an award made by less than all being valid, each of them must act personally in performance of the duties of his office as if he were sole arbitrator; for, as the office is joint, if one refuse or omit to act, the others can make no valid award. As they must all act, so they must all act together—be present at every meeting and at the examination of every witness. And, even supposing that the decision of the majority is to be final and binding, their close attendance is assured, for the arbitrators appointed by the parties must ever watch the interests of their "clients," and the umpire, who is *ex hypothesi* an impartial person, is not likely to absent himself for any sinister motive. And it has been decided that the decision of such a tribunal must be the result of their joint deliberations.

Allowing that the Arbitration Act has failed in this very important particular, it must be admitted that the danger which is likely to arise is not very serious, for, as a general rule, the parties will each be anxious to arbitrate and abide by the award of their own Court.

Other signs, however, are not wanting to show that, although "finality" and "speedy justice" are the avowed objects of lay tribunals, the disappointed party is frequently compelled to return to the Supreme Court, and so to pile litigation on top of arbitration, without the added satisfaction of obtaining what he looks upon as justice in the end. Legal procedure, however we endeavour to simplify it, must always be attended with some troublesome rules, which too often escape notice until too late.

Let us see how some of the rules under the Arbitration Act work in practice. It is an established principle that an arbitrator cannot be directed by the Court or a judge to state a special case for the opinion of the Court under Sec. 10 of the Arbitration Act of 1889, when no request or application to state a case has been made before the award has been made and the arbitration concluded. In a recent case, the Court took the opportunity of saying that an award will not be remitted for the reconsideration of an arbitrator upon the sole ground that he has made a mistake in law—the alleged mistake being that he had entirely omitted to consider or apply the ordinary rules of law as to the measure of damages. In considering the effect of Sec. 19 of the Arbitration Act, 1889, Lord Justice A. L. Smith said: "What is the meaning of that section? Without any authority upon the question, I should say that it is applicable only to a case where the question of law is raised during the pendency of the reference, and that a party cannot wait, and then, after the whole matter has been decided and finished in the arbitration, ask that a special case shall be stated." And later on, he said: "I, for my part, have always understood the general rule to be that the parties took their arbitrators for better or for worse, both as to decisions of fact and decisions of law."

The reports of cases arising out of arbitration usually contain but a short statement of the facts of the dispute, and scarcely ever contain any note of the reasons put forward by arbitrators for their decision. This absence of any *ratio decinendi* from an award leads one to suspect that the judgment of a Court of lay arbitrators is not always based solely upon matters which are brought to light at the hearing by the parties or their representatives; while a refusal on the part of arbitrators to state their reasons makes it doubly hard for a dissatisfied party to obtain a review of the matter in a superior Court. In a case which was heard in the Court of Appeal in 1897, the directors of the Liverpool Corn Trade Association had acted as an appeal court for the final settlement of a dispute in connection with a delivery of corn, which had already been determined by arbitration. The directors upheld the award, stating their reasons thus: "After careful consideration of the appeal, and of the application to state a case for the opinion of the Court, and of the reasons for such application, I and my co directors were of opinion that the award of the arbitrators should be confirmed, that

we were competent to deal with the case, and that there were no grounds or necessity for seeking the assistance of the Court." This resolution was passed, in spite of the fact that application for a special case or for an adjournment had been made in order to allow one of the parties to bring a point of law before the notice of the Court.

It may be that, if it is agreed on all hands that the award of the arbitrator shall be finally binding on the parties, however erroneous on points of law or fact, the arbitrators should be careful to avoid giving reasons. Upon this point the principle to be collected from the later case is plain, viz., that the Courts will not look at anything for the purpose of reviewing the decision of an arbitrator upon the matter referred to him, except what appears on the face of the award, or some paper so connected with the award as to form part of it. We recollect a case which arose out of a dispute relating to a ship at sea, where the arbitrator delivered with his award a paper stating his reasons. The Court treated his statement as embodied in the award, which was eventually set aside on the ground that the arbitrator had acted on some marine law, and not on the law of England, in deciding the question of damages.

ELECTROMOBILES FOR TRAMWAY SERVICE.

The rapid extension of automobile fire services in Germany has shown the electric car to be better adapted than any other car to serve as an auxiliary vehicle. Comprehensive comparative tests against petrol and steam cars, have demonstrated the superiority of electromobiles in this special field.

Similar conditions to those of fire-brigade service prevail in connection with tramway operation, there being likewise a demand for cars which in the case any breakdown on the track will quickly arrive on the scene with the emergency crew and their tools. A specially advantageous feature in this connection, is that the care of electromobiles and their accumulators can be entrusted to men employed in other branches of the service who possess the necessary technical knowledge for their operation and maintenance.

The cars described below have been designed and constructed by the Siemens-Schuckert Works as the result of their extensive experience in tramway operation.

The electrically-propelled tower car (fig. 1.) carries a substantial frame capable of being moved up and down by a side lever. This frame is mounted on a very stable chassis, which even at maximum

Fig. 1.—Electrically-propelled Tower Wagon.

speed, and when traversing curves does not show any tilting tendency. On the frame is mounted a platform turning on rollers, which affords a radius as large as possible. Its lowest level is 3·17 m. and the highest 4·87 m. above the ground. A convenient ladder gives easy access to the platform. The interior of the frame contains a large case which serves for carrying tools and spare parts.

The car accommodates two men besides the driver.

The electrically-propelled car represented in figs. 2 and 3, carries a large and stable standing ladder, which when extended is 5 m. in height. This ladder is readily erected or folded up, and allows any part of the tramway trolley wires to be reached. A number of auxiliary tools, such as capstans, levers, crow-bars, scissors, arc lamps, fire-extinguishing implements, &c., are provided for use in case of accident.

Four seats are provided on each of the two longitudinal sides of the car for the crew, as well as two beside the driver and two at the back, so that the car may carry as many as 12 men.

Instead of fitting these seats outside the car, they may be arranged like those of a 'bus, in the interior of a special structure.

The chassis is especially remarkable for the ease with which the battery, arranged in a readily accessible position in front of the driver's seat, can be exchanged. The single-motor system in

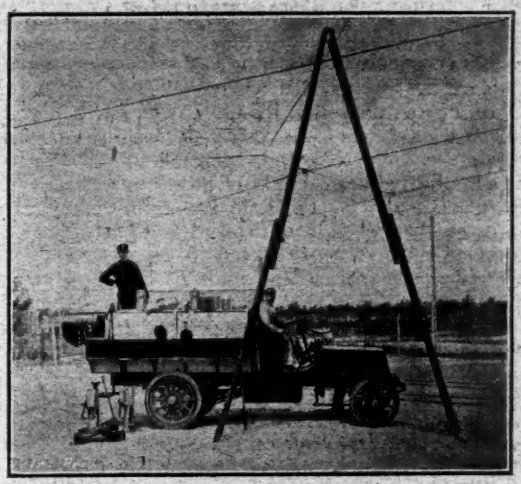

Fig. 2.—Electric Ladder Wagon; Ladder in use.

this case allows of a more effectual protection of the motor against dirt and damage, while the efficiency of the motor on bad roads and steep gradients, in spite of heavy loads, drops only slightly. This is due to the low ohmic resistance of the motor and the fact that the efficiency of the toothed gear rises as the load increases.

Tests made on the motor have shown that its efficiency is well maintained in the case of considerable overloads, being as high as 80 per cent. at 80 volts, with a torque three times as high as the

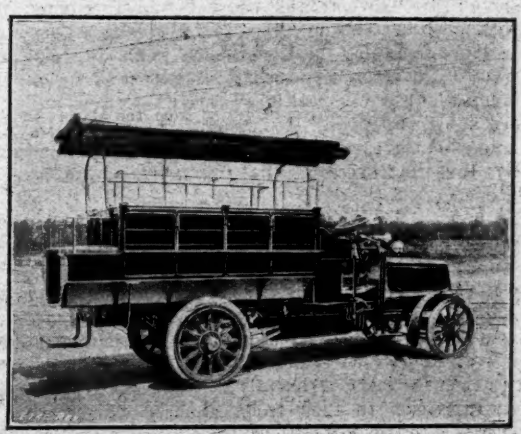

Fig. 3.—Another Form of Ladder Wagon.

normal figure. In the case of a lower working pressure (35 volts), the two halves of the battery being connected up in parallel, the motor is able safely to yield for short periods seven times its normal torque.

Carbide of Calcium.—The Brandenburg Carbide and Electricity Works Co. has been registered at Berlin with a capital of £175,000 to take over the undertakings of the Brandenburg Carbide Works and the East German Water Power Co. for the sum of £118,500 in shares. The balance of the share capital has been subscribed by various banks, including the Zurich Bank for Electrical Enterprises. In addition to continuing the production of carbide of calcium and calcium cyanamide hitherto carried on by the Carbide Co., the new company will develop the hydro-electric works in the district of Schneidemühl for the execution of contracts arranged by the East German Co.

Centrifugal Pumps.—A further order which Messrs. Jens Orten-Böving & Co. have received for centrifugal pumps manufactured to their designs by Messrs. Willans & Robinson is for two pumps to deliver 200 gallons per minute against a head of 535 ft. at 1,440 R.P.M. The main contractors for the work are the British Westinghouse Electrical and Manufacturing Co., Ltd., and the consulting engineers are Messrs. Rendel & Robertson.

WHAT IS THE "EXPRESSION" FOR "SUCCESS IN THE ELECTRICAL ENGINEERING PROFESSION?"

By "ARAMIS."

In all the numerous published letters and articles recently written by unsuccessful disappointed "engineers" bemoaning the want of sympathy on the part of the world in general, and of their individual employers in particular, not one such complainer has said anything about "human qualifications." It seems to be firmly fixed in the minds of at least nine-tenths of the men who are striving to attain success in the engineering profession that all that is required is to have a natural liking for pulling things to pieces (either actually or verbally), to study a little mathematics in a fairly intelligent way, and to know enough about electrical science and kindred subjects to be able to argue in a stupid sort of way about points which do not matter at all. On this knowledge they expect to attain to high positions. If they do not, they say it is because they lack influence; they never dream that they may lack ability, neither does it ever cross their minds that their knowledge may not be of the kind required.

The most difficult subject they, as a rule, know nothing at all about—never even suspect its existence—but without a good working knowledge of this subject, they will never be able to show what they are really capable of in the way of technical achievements. This subject is not taught in the technical institutions, nor is it heard of much outside them. To a few—the born leaders—it comes as a gift of Nature, but by careful study and observation it may be acquired by all, in a degree varying according to the ability of the student. This subject is a somewhat difficult one to define, but a perusal of what follows will show the reader what it embraces. It can, perhaps, be best expressed as the French express it, by "savoir faire," which is traditionally rendered into English by the word "tact," but this is a very weak translation. Taking the two French words "savoir," and "faire," and translating each separately, their meaning in combination becomes clearer. "Savoir"—"to know," "to have a knowledge of," "to understand"; and "faire"—"to do," "to arrange," "to manage." Their joint meaning may thus be expressed by "to have a knowledge of management."

It is just this knowledge which these "disappointeds" have not. It is just this part of their education which they have neglected—thinking that technical education being the greater includes the lesser, whereas technical education is in reality itself the lesser; consequently their estimate of the world and its ways is an inaccurate one, and their vision is blurred. They have neglected to get into right relationship with their fellows, consequently they are never able to give full expression to their technical ideas, because they are never able to rise to positions where their technical knowledge would be most useful. If, instead of going on studying hard at technical subjects which they may never want, these disappointeds, and others following in their groove, would devote some of their time outside business to intelligently reading history, classical literature (which is not necessarily dry and uninteresting), biographies of great men in all professions, and other subjects which would give them some idea of the relation of man to man, and of men to the world, they would be doing something to make themselves happier, more useful to themselves, and much more interesting to those outside the engineering business, who come in contact with them. Besides, they would be really in almost every case making a greater step towards the improvement of their positions, than if they continued technical study entirely. Of course, it is not suggested that technical study should be given up, but only that less time should be given to it until such time as each individual sees there is some likelihood of profound technical knowledge being of real use to him. The reading of subjects in which "man, and his ways and habits" are treated, will reflect itself in the reader's work, and improve his relations with those people with whom he has to deal, either as superiors, equals, or subordinates. Many a great man owes his life's success and the fortune and satisfaction it has brought with it, to his good relationships with other people, which have caused him to become a favourite and to be advanced from position to position, thus giving him the opportunity he wanted to show what things he was capable of accomplishing. It is just the lack of this opportunity which the disappointeds complain of, but let them give up the study of volts and amperes for a time and turn to the study of their fellow-creatures. If they apply themselves as assiduously to this study as they do to the study of technical subjects, they will find themselves gradually becoming more and more able to make and improve opportunities for themselves, and it will give them that knowledge of *savoir faire* which at present they despise, but of which their ignorance is keeping them down in subordinate positions for which their technical knowledge is already very much too great.

Some time ago, in one of the American technical papers, a great engineer, who is connected in an administrative capacity with companies employing many thousand men, stated that it was his constant experience that it was very much easier to hire "engineers" than "men;" by which he meant, as he went on to explain, that he found no want of technical knowledge among applicants or acting engineers, but nearly always defects in character, such as want of courage, initiative, ambition, imagination, tact, &c. These defects kept many otherwise brilliant engineers down in small positions. It is exactly the same with us here. Our "engineers" will persist in believing in technical education as the source of all good. Technical education, however, is only one of the many means by which men of strong character may attain success. If it is only by various forms of technical education that great names and large fortunes are to be made, how does it come about that men can build up huge retail businesses from small beginnings, as Lipton, Whiteley and many others have done? Their businesses cannot have been built on profound technical knowledge. They have been built up by great masters of *savoir faire*, masters instructed by Nature. Their mastery of this subject has made their dealings easy and pleasant to both the public and their staffs. Great leaders have always been remarkable for the good relationships existing between them and their subordinates. Take any one of these complaining disappointeds and place him in charge of a few men, and it will almost certainly be found that he cannot get the best results out of his charge; he either drives those he should coax, and so coaxes those he should rule firmly that they soon start leading him; or, by his tone and manner, he stirs up little dislikes in every one of them, and turns the whole lot against him.

In any case, few, if any, of the men are satisfied, and doing their best. This applies to staff or workmen. With all their technical skill they have none of that knowledge of which all management, either of staff or men, is the practical application. If they so easily stir up dislikes in subordinates, it is also highly probable that they equally stir up dislikes in those above them, but as these latter are men of character, this has only the effect of keeping the man down, and there is no active manifestation of the dislike such as comes from below. Consequently it is never brought to the man's notice that it is simply his want of tact, and ignorance of *savoir faire*, that is keeping him back. The overtrained technical man is usually strongly given to forcing his own opinions down the throats of all those who have dealings with him. This, with his usual crass ignorance of anything not "technical," causes him to be shunned and detested by all except those other technicians who are in his own groove. The study of humanity does not mean that he must become a Socialist—if he studies the subject intelligently there will be no fear of his doing that—but it does mean that he will find more interest in his daily work, that he will gain tact, that he will soon begin to take the lead among the technical men he is working with; and this is the first step towards a better position. Why does such study do all this? Because, by broadening the mind and the outlook on life, by giving correct ideas of man's relations to man, it strengthens the character and gives it force, determination and energy: qualities rare among "technical" men, but without which no great success is possible.

Force of character, by making a way for itself, increases the value of any knowledge with which it may be associated, for it is obvious that it is the knowledge of the capable

forceful one that will be used, while the knowledge (perhaps greater) of the less energetic one will lie idle, and be of no more use to its possessor, or the world in general, than if it never existed.

Force of character stands outside the brackets in the expression for success—all other qualifications are only terms inside them. Thus, for the benefit of those who only appreciate facts when set out in a formula—

Success in the engineering (or any other) profession

= Force of character (A + B + C + D + E + . . .),

where A = Technical knowledge,
B = Practical experience,
C = Natural aptitude,
D = Commercial knowledge, and so on.

LEAKAGE CURRENTS.

By "H. P. M."

Much has been said of "leakage currents," and still a large field is left open to be explored; the disastrous results which have from time to time shown themselves, go to prove that a real danger does exist, and should be fought with every care, for there are a good number of towns, whose electrical installations have been in use for some time and who have not in the initial stages of the undertaking been sufficiently acquainted with the dangers of these leakages to protect their mains, or take the precautions which have been taken in the more modern systems.

It is only intended in this article to give a short description of some of the damage its and causes, which have been observed by the author in actual practice.

One case which was brought to his notice a short time ago had several interesting features. The system was a three-wire direct-current one; the cables, lead-covered and armoured, laid direct in the ground, the distributors being three single cables; the leads had been made continuous by bonding, the bonding being done by the clamping of the joint box on to the lead, by drilling the gland on the box slightly smaller than the diameter of the lead.

In the course of time the tramways systems was electrified, and shortly after the troubles commenced on the lighting mains. Naturally the tramway return currents were blamed for this, and investigations were commenced on this basis, the result being that additional return feeders were laid, the return feeders being connected to the nearest point of the rails to the station; but the troubles still continued, the mains frequently breaking down to earth, services being burnt out, and general interruptions occurring; the earth currents gradually became larger on each occasion until as much as 600 amperes out of balance were obtained. This large out-of-balance showed clearly that the insulation of the neutral wire was in very bad condition, and it was afterwards found that no less than 18 absolute dead earths were cleared off from the neutral cable; this clearing of the faults on the neutral obviated the danger to the continuity of supply, for any leakage had then to return to the earthed neutral at the station which was controlled by a resistance.

After these neutral faults had been cleared up it was decided to search closely for the source of the trouble, for after the first hour of 600 amperes going to earth anything could be accounted for. It was obvious that the one great fault had been in neglecting to keep up a proper system of testing the neutral wire, which had, no doubt, broken down to earth some time previously to the faults occuring on the outers, and it was eventually found that a leakage current had been circulating on the leads of the cable due to the faulty connecting up of the earth connection on the neutral wire at the station; this had been coupled to the rail bus-bar of the traction system under the impression that it was at earth potential, whereas it was at a varying point between 5 and 15 volts below earth the whole of the time the tramways were in operation, according to the amount of load which happened to be on at that particular time, thus causing a local circuit as shown on fig. 1.

The path of the current from the rails to the fault at the neutral would naturally be the path of least resistance, say at a point where the rails and mains were brought close together, such as a road crossing; the leads of the cables then would carry a current of from 2 to 6 amperes (tested) to the neutral fault, and this current flowing along the leads and through the faulty bonding at the joint boxes, eventually burnt away the lead, and thus brought on the faults.

A great deal of damage may also have been caused previously to the tramways being electrified by the neutral fault alone, for if the insulation of the neutral had been broken down, a local circuit would have been set up between the

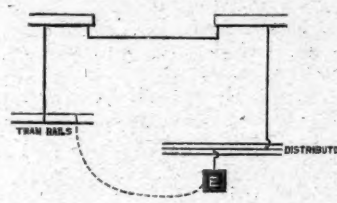

Fig. 1.

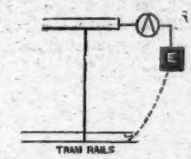

Fig. 2.

neutral fault and the earthed neutral at the station due to the difference of potential at the two points of the neutral according to the load; the author measured this leakage current up to ·3 ampere in places where a small section of cable was used for the neutral.

Another case which was brought to his notice was on a similar system — the troubles commencing shortly after the tramways had commenced, and due to the wrong connections on the traction switchboard, the ammeter for measuring the current from rails to earth having been connected from the rail bus-bar and earth at the station as in fig. 2; the result was an additional return feeder along all conducting materials between the rails and the station, the chief conductor unfortunately being the leads of the lighting feeders.

Another system with which the author is acquainted gave similar troubles, which were put down to tramway leakage. The matter was investigated, but it was some considerable time before the source of the current could be located; it was eventually discovered that one of the return feeders had been damaged just outside the cable trench, and was making a good earth connection, thus causing the earth to be used as a parallel return feeder. This points to the importance of keeping a careful test upon the return feeders, for the positive feeders quickly show when they are in trouble.

A case which came under the author's observation was one in which the insulation of a lead-covered cable was found to be gradually dropping; in this case it was a feeder, on a direct-current system, and it was at last considered necessary that the cable should be inspected; upon inspection it was found to be covered with a white corrosion. The feeder was lead covered, with a layer of impregnated jute on the lead, and was laid in a wooden trough filled with pitch. On examining the cable more closely, it was found that the corrosion was in layers corresponding to the wrapping of the jute covering, giving the appearance of the pitch being the cause of the trouble, and only attacking the lead where it could get between the layers of jute; but on further investigation, it was found that the corrosion was only taking place on the feeder where it was laid parallel to the distributors. In places where there were no distributors, no sign of any corrosion could be traced, but it may also be noted that in each case tramway rails ran parallel to the feeder, so that it appeared to be due to no effect of the return current from the tramways. On searching further into the matter, it was found that the neutral of the distributors alongside of which the feeder was laid had several small leakages, this pointing to the fact that the corrosion was apparently due to this small current having some direct effect upon the lead, or else acting upon the lead due to some foreign matter in the compound with which the jute was impregnated, or else in the pitch.

It will, therefore, be seen from the few instances given above that the troubles arise not from the cables in which

the danger is supposed to lie, but in those cables which, by reason of their being nominally at "earth potential," are treated with disrespect, and in a great many cases with contempt.

WELDING RAIL BONDS.

From the earliest days of electric traction with rail return, the bonding of the rails has been a troublesome and costly operation, and, even when carefully carried out on the most approved methods, t has always remained a possible and probable source of trouble and expense, owing to the liability for moisture to find its way between the contact surfaces and to corrode them, thus introducing resistance into the return circuit to a serious extent. The only absolutely reliable method of completely obviating this trouble is that of actually welding the bond to the rails; this expedient has not up to the present been adopted in this country, so far as we are aware, though the equivalent process of welding the rail joints has been used to some extent, but it has been successfully employed in the United States for some two years, and the results have proved so satisfactory, we are informed, that the Forest City Co. has decided to introduce the system here, and has just issued a booklet in which particulars of the system are given.

Two methods are employed, electric welding and copper welding, both of which are fully protected by patents. The former process resembles that of electrically welding the joints of the rails, and is carried out with the aid of a small car, upon which the apparatus is mounted, consisting of a rotary converter with the necessary switchgear and the welding transformer; the converter also serves to propel the car along the track, a trolley pole being provided on the top of an iron framework, which carries the canopy and side curtains to protect the gear from the weather. In order to remove the car from the track when necessary to prevent interference with the ordinary traffic, a screw-jack worked with bevel gears and cranks is fixed under the centre of the truck, so that the car can be raised from the rails, turned round and wheeled off the track. The general appearance of the car is shown in fig. 1 herewith.

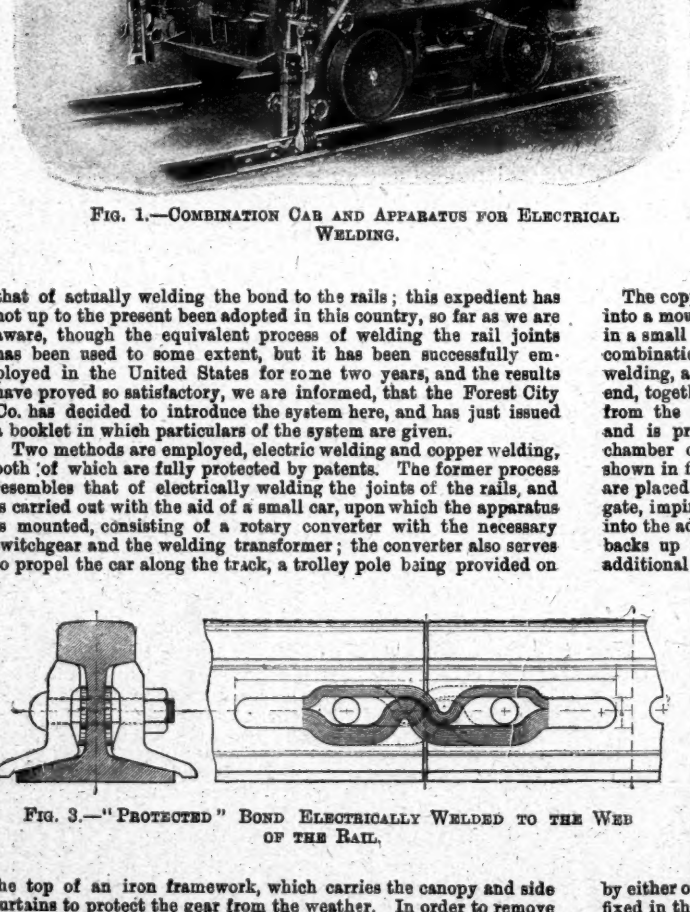

Fig. 1.—Combination Car and Apparatus for Electrical Welding.

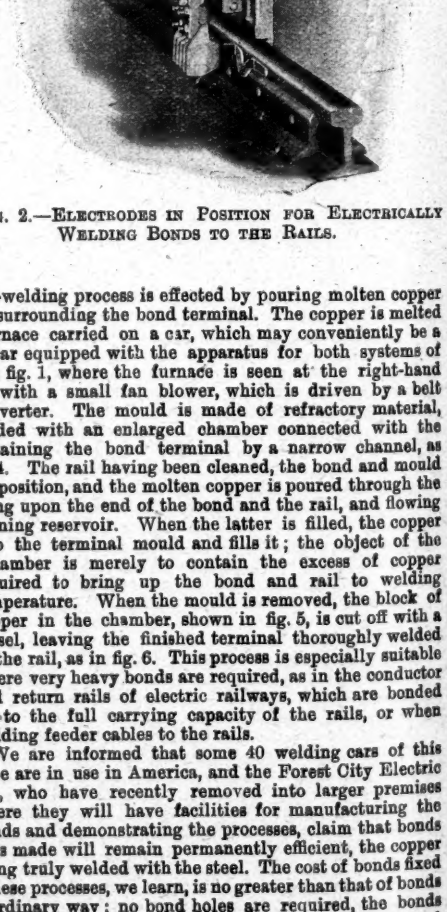

Fig. 2.—Electrodes in Position for Electrically Welding Bonds to the Rails.

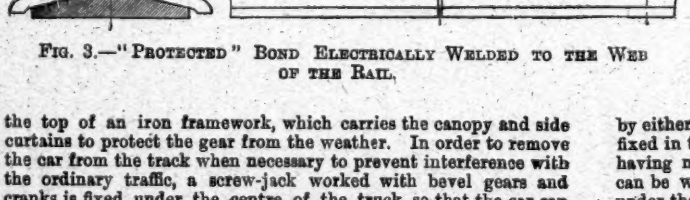

Fig. 3.—"Protected" Bond Electrically Welded to the Web of the Rail.

When trolley current is not available, a petrol engine is employed to drive the converter as an alternator.

The converter, which is rated at 18 kw., is fed with a current of about 20 amperes at 500 volts from the trolley wire, and supplies the transformer primary with single-phase alternating current; the secondary of the transformer is connected to the welding clamps, the electrodes of which consist of copper and carbon respectively (fig. 2).

To perform the welding process, the surface of the rail is first ground bright at the place where the bond is to be applied, either on the web or at the side of the head of the rail. The copper electrode is then applied to one side of the rail, and the copper bond, with its terminal enveloped in brass, is placed in position on the other side, after which the carbon electrode is pressed against the bond terminal and the current is switched on, amounting to about 2,000 amperes at 5 volts in the case of a No. 0000 bond. The resistance at the contacts between the carbon electrode, bond terminal, and rail causes these to attain a high temperature very quickly, and the operation of welding is completed in about one minute. Fig. 3 shows a "protected" bond thus welded to the rail.

The copper-welding process is effected by pouring molten copper into a mould surrounding the bond terminal. The copper is melted in a small furnace carried on a car, which may conveniently be a combination car equipped with the apparatus for both systems of welding, as in fig. 1, where the furnace is seen at the right-hand end, together with a small fan blower, which is driven by a belt from the converter. The mould is made of refractory material, and is provided with an enlarged chamber connected with the chamber containing the bond terminal by a narrow channel, as shown in fig. 4. The rail having been cleaned, the bond and mould are placed in position, and the molten copper is poured through the gate, impinging upon the end of the bond and the rail, and flowing into the adjoining reservoir. When the latter is filled, the copper backs up into the terminal mould and fills it; the object of the additional chamber is merely to contain the excess of copper required to bring up the bond and rail to welding temperature. When the mould is removed, the block of copper in the chamber, shown in fig. 5, is cut off with a chisel, leaving the finished terminal thoroughly welded to the rail, as in fig. 6. This process is especially suitable where very heavy bonds are required, as in the conductor and return rails of electric railways, which are bonded up to the full carrying capacity of the rails, or when welding feeder cables to the rails.

We are informed that some 40 welding cars of this type are in use in America, and the Forest City Electric Co., who have recently removed into larger premises where they will have facilities for manufacturing the bonds and demonstrating the processes, claim that bonds thus made will remain permanently efficient, the copper being truly welded with the steel. The cost of bonds fixed by either of these processes, we learn, is no greater than that of bonds fixed in the ordinary way; no bond holes are required, the bonds having no terminal shanks. Any of the standard types of bond can be welded to the rails. The short "Protected" type of bond under the fish-plate is especially recommended, as it is economical both in copper and in resistance—the resistance of, say, two No. 0000 bonds over the fish-plates being something like three times that of

Fig. 4.—Bond Wires in Mould, in Copper-Welding Process.

Fig. 5.—Bond after Pouring Molten Copper.

Fig. 6.—Finished Bond, after Cutting Away Surplus Metal from the Terminals.

the corresponding length of rail; with the welded joint the bond requires no inspection, and the fish-plate protects it from mechanical injury.

The New Argentine Cable Question.—Some further particulars relating to the agreement concluded between the Argentine Government and the Western Telegraph Co, for the laying of a cable between Buenos Ayres and Ascension Island, on terms which are said to give the company a veiled monopoly of establishing cables touching the Argentine coast, have been forwarded to a German newspaper by a Buenos Ayres correspondent. It appears that the German Government made an inquiry on the subject, through the Argentine Ambassador in Berlin, and at the same time pointed out Germany's right to the most-favoured-nation treatment. In reply, the Government of Argentina stated that the agreement did not grant a monopoly, and, moreover, protested that it was not compelled to listen to foreign claims in respect of any such agreement. It is not known what reply the German Government has given, but the Senate has now adopted the agreement without discussion, and the correspondent states there is no doubt that the Lower House will also do so. The Reporter of the Commission of Public Works, in introducing the authorising Bill in the Senate, referred to Clause 17, which is said to represent the alleged monopoly. This clause provides that if within a period of 25 years from the date of the notarial completion of the agreement, any undertaking should make proposals to the Government, which would appear advantageous to the latter for the laying of a new submarine cable between Argentina and another country, preference will be granted under the same conditions to the Western Telegraph Co. The Reporter stated that the preference embodied in the clause could only probably be directed against fresh English competition, as the British Government from the beginning would not be likely to permit a French or German cable to utilise a British possession as a landing place, and no nation other than England possesses its own islands within reach in the South Atlantic Ocean. But if Germany or France wished to undertake to lay a cable direct from Buenos Ayres to a point belonging to either of them on the African coast, the German or French Government would conversely in this case render it impossible for an English competitive company to obtain a landing there, so that the Western Telegraph Co. could not compete in regard to such a cable. The correspondent remarks, however, that this alternative is incorrectly formulated, as it might be convenient for France or Germany to lay a cable from a Brazilian station to Argentina, and that in this event the Western Telegraph Co. could all the more easily hinder foreign rivalry on the ground of its preferential right, as the company has common business interests with the cables passing *via* Brazil. Apart from this preferential right, the position of the company will become still more unassailable, as it receives by Clause 13 a monopoly of the transmission of all official cable messages, and of all those trans-marine messages reaching the State telegraph offices which do not expressly specify another route. The company is also granted exemption from import duties for all materials, freedom from dues for its cable ships, and exemption from all State, provincial and municipal taxes for the period of 25 years. The only return given by the company, the correspondent concludes, is a reduction of at least 15 centavos per word in the tariff for messages *via* Brazil, or the so-called Madeira line, but this concession is illusory, as all large customers of the Madeira line, which is virtually identical with the new cable, enjoy a rebate.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE—GUADELOUPE.—The duties are the same as fo France, with certain exceptions. Certain octroi duties are also levied on imported goods, as follows:—

Cement of all kinds	·30 fr. per 100 kg
Pipes and moulded articles of cement ...	1 „ „
Tars and bitumens	1 „ „
Heavy oils, petroleum, residues and other mineral oils	6 „ „
Iron or steel in bars, rails	·60 „ „
„ „ „ other	1 „ „
Axles and tires of iron or steel	12 „ „
Iron wire, even covered with other metals	7 „ „
Copper in wire of all dimensions	15 „ „
„ „ on thread or silk	30 „ „
Electric incandescent lamps	10 % ad. val.
Manufactures of cast-iron	6 fr. per 100 kg.
Iron and steel tubes...	5 „ „
Copper tubes	15 „ „
Copper manufactures	15 „ „
Lead pipes and other manufactures ...	3 „ „
Electrical machinery and detached parts...	6 % ad. val.
Machines and machinery, other	3 „ „
Boilers...	3 „ „
Railway carriages, fitted	20 fr. each.
„ „ not fitted	5 „ „
Telephone and telegraph apparatus ...	10 % ad. val.

The following are free of octroi duty:—Articles of all kind imported by the Administration: instruments, cables, wire and othe materials necessary for the construction and service of telegrap and telephone lines subsidised by the Colonial Government turbines, multitubular boilers, steam pumps, locomotives, truck rails, &c., under special conditions.

FRANCE—MADAGASCAR.—The same duties are levied as o goods imported into France, with some unimportant excep tions.

FRANCE—MARTINIQUE.—The same duties are levied on similar goods imported into France, with some unimportant exceptions; in addition, certain octroi duties ar also levied on imported goods, as follows:—

Cast-iron	·50 fr. per 100 kg.
Iron in bars, angle, rails, plates, &c. ...	1 „ „
Tin plate	1·50 „ „
Iron wire, tinned, galvanised or not ...	1·50 „ „
Steel in bars, rails, &c.	1 „ „
Copper and copper wire	9·65 „ „
Machines and machinery of all kinds, boilers, machine tools, &c.	As the metal of which composed.
Railway sleepers of iron	·50 fr. per 100 kg.

FRANCE—MAYOTTE.—The same duties are levied as on similar goods imported into France.

Large Mexican Hydro-Electric Plant.—Manue Cuesta, of Guadalajara, who is at the head of the Chapala Power and Irrigation Co., which has just been organised with a capital stock of $8,000,000 Mexican money, says that the hydro-electric plant which the company will construct for the purpose of providing water for irrigation will cost more than $2,000,000. It is probable that two of these power plants will be built—one to be located on the Santiago River near Guadalajara and the other on a stream that empties into Lake Chapala. Transmission lines will be built to operate the pumps, which will be located upon the shore of Lake Chapala, the water of which will be used to reclaim 75,000 acres of land. The Government loan of $3,000,000, which was recently made to the company, is secured by a lien upon the land that is to be reclaimed on a basis of $100 per acre. An additional loan of $2,000,000 has been made the company by the Caja de Prestamos, or Loan Bank, of this city. This money will be used to build about 110 miles of main irrigating canals and to establish three pumping stations. While the first unit of this great system of irrigation will provide for the reclaiming of 75,000 acres of land, the plans, when completely rounded out, will involve the irrigation of more than 500,000 acres. The Pimintel interests of the City of Mexico, which own the street railway, light and power systems of Guadalajara, are associated with Mr. Cuesta in the enterprise.—*Electrical World.*

Porcelain Ware on the Continent.—It is announced that the International Syndicate of makers of porcelain ware for electrical purposes, of Berlin, which is composed of German and Austrian firms, was compelled to release prices in the spring from the fixed rates, owing to the competition of outside makers, and thus left it to the syndicate constituents to arrange their own quotations individually. The contest which has taken place in the meantime has been so severe as to result in losses both to the constituents and the outside makers. Some of the latter are declared to have become involved in financial difficulties, whilst others have discontinued the manufacture of porcelain ware for electrical purposes.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,317. "System for maintaining the electric circuit of metallic-filament incandescent lamps burning in series on failure of one or more such lamps." N. R. Booth and J. Hamer. July 26th.

17,326. "Improvements in or relating to hangers and the like for electrical conductors." E. M. Munro and Railless Electric Traction Co., Ltd. July 26th.

17,342. "Improvements in electric furnaces." Aktiebolaget Elektrometall. (Date applied for under Sec. 91 of the Act, August 1st, 1908, being date of application in Sweden.) July 26th. (Complete.)

17,353. "Improvements in or relating to electrical heating apparatus." A. F. Berry. July 26th. (Complete.)

17,355. "Improvements relating to telephone apparatus." E. A. Graham. July 26th. (Complete.)

17,370. "Improvements in and relating to the control of polyphase motors and the like." British Thomson-Houston Co., Ltd. (Allgemeine-Elektricitäts Ges., Germany.) July 26th. (Complete.)

17,424. "Improvements in automatic electric piano players." G. E. Hermes and E. F. Paventa. July 27th.

17,448. "Improvements in or relating to arc lamps." T. L Carbone. (Date applied for under Sec. 91 of the Act, November 9th, 1908, being date of application in Germany.) July 27th. (Complete.)

17,450. "Improvements in wireless signalling." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, March 8th, 1909, being date of application in United States.) July 27th. (Complete.)

17,459. "Improvements relating to the separation of substances by the wet magnetic process." W. E. Lake. (F. Krupp, A.G. Grunsonwerk, Germany.) July 27th. (Complete.)

17,473. "Improvements in telephonic transmitters." P. Stragiotti. (Date applied for under Sec. 91 of the Act, August 11th, 1908, being date of application in United States.) July 27th. (Complete.)

17,486. "Improvements in or relating to the lighting of gas burners electrically." M. Delage and P. Woog. (Application for Patent of Addition to No. 16,341, 1909.) July 27th. (Complete.)

17,488. "Appliance for preventing fraud in connection with electricity meters." G. Berardi. July 27th. (Complete.)

17,490. "Improved electromagnetic separator with rotating magnet drum." F. Steinert and H. Stein. (Date applied for under Sec. 91 of the Act, July 27th, 1908, being date of application in Germany.) July 27th. (Complete.)

17,516. "Improvements in means for preventing overwinding and underwinding electrically-driven cranes, capstans, lifts and the like." H. Wardale and W. R. Storey. July 28th.

17,520. "Improvements in induction motors." J. H. Holmes. July 28th.

17,542. "Improvements in micro-receivers or translators." P. Stragiotti. (Date applied for under Sec. 91 of the Act, August 11th, 1908, being date of application in United States.) July 28th. (Complete.)

17,555. "Improvements in and relating to electrical and other recording, signalling, measuring instruments and the like." E. S. Heurtley. July 28th.

17,561. "Improvements in and relating to electric fly switches." C. J. Baker. July 28th. (Complete.)

17,564. "Improvements in and relating to rotary converters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 28th.

17,610. "Improvements in balancers, auto-transformers and boosters for use on direct-current systems." A. M. Taylor. July 29th.

17,627. "Electric incandescent lamps with metal-filament loops." H. Kuzel. (Application for Patent of Addition to No. 15,017, 1907; date applied for under Sec. 91 of the Act, January 4th, 1909, being date of application in Germany.) July 29th. (Complete.)

17,654. "Improvements in relay apparatus particularly intended for use in connection with telephonic and telegraphic systems." S. G. Brown. July 29th.

17,663. "Improvements in high-tension magnetos." T. M. Mueller. (Date applied for under Sec. 91 of the Act, August 4th, 1908, being date of application in United States.) July 29th. (Complete.)

17,664. "Improvements in magneto-electric machines." T. M. Mueller. (Date applied for under Sec. 91 of the Act, February 25th, 1909, being date of application in United States.) July 29th. (Complete.)

17,711. "Improvements relating to pendant electric light fittings." S. K. Thompson. July 30th.

17,739. "Improvements in and relating to the automatic regulation of dynamo-electric machines." H. M. Taylor and R. H. Scotson. July 30th.

17,740. "Improvements in flexible tubular conduit systems for electric installations." G. Evans. July 30th.

17,742. "Improved apparatus for rectifying alternating currents." E. Giglio. (Date applied for under Sec. 91 of the Act, April 29th, 1909, being date of application in Switzerland.) July 30th. (Complete.)

17,758. "Improvements in and relating to the control of polyphase motors and the like." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, July 31st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,759. "Improvements in and relating to condensing systems." A. Wolf. (Date applied for under Sec. 91 of the Act, August 1st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,761. "Improvements in or relating to closed circuit transformers." Electric Reductor Co. m.b.H. (Date applied for under Sec. 91 of the Act, July 31st, 1908, being date of application in Germany.) July 30th. (Complete.)

17,763. "Improvements in recording devices especially applicable for use with measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 30th. (Complete.)

17,774. "Improvements in or relating to electric telegraphy." S. G. Brown, W. Judd and A. R. Hardie. July 30th.

17,783. "Improvements in and relating to devices used for recording a copy of an invoice, receipt, telephone message or the like." J. W. Tunstall. July 31st.

17,790. "Improvements in devices for indicating rise in potential of trolley standards or other metal work of electric tramcars." A. Imbery. July 31st.

17,798. "Improved system of and apparatus for wiring buildings and the like for the distribution of electricity." Simplex Conduits, Ltd., and L. M. Waterhouse. July 31st. (Complete.)

17,812. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. July 31st.

17,813. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. July 31st.

17,814. "Improvements in wireless telephony." F. J. Chambers. July 31st.

17,834. "Improvements in or relating to electric dry batteries." D. Fuller. July 31st.

17,835. "Improvements in electric magnets or solenoids for use with single-phase alternating currents." D. Bone, T. H. J. Simmons and R. Waygood & Co., Ltd. July 31st.

17,847. "Improvements in reversible variable-speed dynamos." H. Leitner. July 31st.

17,863. "Improvements in and relating to electric motors." D. Maggiora and M. Sinclair. July 31st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Soldering of the Metallic Filaments of Electric Lamps to their Electrodes. S. Marietti. 14,483. July 8th. (Date applied for under International Convention, July 8th, 1907.)

Starting Switch for Electric Motors. D. Timar and C. von Dreger. 14,513. July 8th. (Date applied for under International Convention, August 19th, 1907.)

Magnetic Clutches. H. W. Ravenshaw, V. G. Middleton and W. E. Townsend. 14,530. July 8th.

Regulation of Electric Motors. British Thomson-Houston Co. and Garton. 14,700. July 10th.

Process for rendering Artificial Stone, Mortar, Plaster and the like Waterproof, Heat and Electricity Non-conducting and Soundproof. J. Kathe. 15,100. July 16th.

Electromagnetically-operated Switches. British Thomson-Houston Co. (General Electric Co.) 16,298. July 31st.

Storage Batteries. J. Bimeler. 16,529. August 5th.

Spark Distributors for use in Electrical Ignition Apparatus for Internal-Combustion Engines. E. Denieport. 18,812. September 8th.

Holders, Sockets, or like Attachment Fittings for Electric Lamps. F. W. Bayliss. 20,877. October 3rd.

Measuring-Instruments for Alternating Currents according to Paalzow-Rubens's Bolometric Principle. H. Lux. 21,526. October 12th. (Rights under Sec. 91, Patents, &c., Act, 1907, not granted.)

Portable Switch or Key for Electric-Flash Signalling Purposes. A. C. Davey. 22,345. October 21st.

Universal Joints or Couplings for Electric Light Fitting and other Purposes. C. J. Thursfield. 25,279. November 25th.

Electric Signalling System. A. Blackall and T. Jacobs. 27,436. December 17th.

Means for Indicating Faulty Leads in Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 108. January 2nd.

Electric Flash Lamps. W. D. Whyte. 3,252. February 10th.

Armatures for Magneto-Induction Machines. Firm of Robert Bosch. 3,511. February 12th. (Date applied for under International Convention, November 20th, 1908.)

Multiple-Switch Starting Devices for Electric Motors. H. E. Lake. (Cutler Hammer Manufacturing Co.) 3,517. February 12th.

Sheet-Metal Telephone Cases. C. E. Bilton. 9,999. April 27th.

Commutators for Dynamo Electric Machines. Siemens Schuckertwerke Ges. 11,904. May 20th. (Date applied for under International Convention, July 31st, 1908. Application for Patent of Addition to No. 4,240/07.)

Brush Holders for Dynamo-Electric Machines. Allgemeine Electricitäts Ges. 13,231. June 5th. (Date applied for under International Convention, June 6th, 1908.)

Alternating Electric Current Distribution Systems. J. S. Peck. 13,762. June 11th. (Date applied for under Rule 13, July 15th, 1908.)

Alternating Electric Current Distribution Systems. J. S. Peck. 13,763. June 11th. (Date applied for under Rule 13, July 15th, 1908.)

1908.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 1,270. January 18th.

Machines for Electrically Welding Chains. Akt.-Ges. Stahlwerke Weissenfels vorm. Göppinger & Co. 2,642. February 3rd. (Date applied for under International Convention, February 3rd, 1908.)

Life-guards for Electric Tramcars and the like Vehicles. H. W. Johnson and W. Steele-Brown. 3,280. February 10th.

Trolleys or Rotary Collectors for Electric Cables. J. J. Bennett, L. B. Estes and R. Evans. 5,018. March 1st.

Apparatus for Measuring Alternating Electric Currents. S. Guggenheimer and P. F. C. Gossen. 5,413. March 5th.

Electrical Resistances applicable for Electric Heating, Cooking and other Purposes. G. Cooper and F. C. Sharp. 6,106. March 15th.

Telephone Installations. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 6,878. March 22nd.

Transformers for Operating Vapour. F. Conrad. 7,630. March 30th. (Date applied for under International Convention, April 10th, 1908.)

Heating Coil Protecting Devices for Weak-Current Electrical Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 8,108. April 5th.

Switch-Plugs for Telephone Exchanges. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 9,592. April 22nd.

Electric Aural Instrument for the Alleviation of Deafness. W. H. Warn. 8,210. April 13th.

Manufacture of Bodies of Metallic Titanium, particularly for Filaments for Electric Incandescent Lamps. C. Trenzen and F. R. Pope. 14,852. July 13th.

Manufacture of Metallic Filaments for Electric Incandescent Lamps. C. Trenzen and F. R. Pope. 14,853. July 13th.

Alternating Electric Current Distribution Systems. J. C. Peck. 15,047. July 15th.

Armoured Electric Cables. R. Y. Gray. 15,054. July 15th.

Coin-controlled Mechanism for Gas, Electricity and other Meters. L. Stoneham and S. Stoneham. 15,186. July 16th.

Method and Means for Controlling or Braking Electrically-operated Machinery. C. W. Birkett. 15,268. July 18th.

Regulation or Control of Electric Motors. Johnson-Lundell Electric Traction Co. and W. A. Price. 15,275. July 18th.

Electric Driving of Spinning Frames and similar Machines. J. & T. M. Greeves, Ltd., and R. V. Eves. 16,144. July 30th.

Electrical Fuses. R. Thomas and E. Thomas. 20,758. October 2nd.

Sand Gear "Sanding Pipe" for Electric Tramcars, Motor-Omnibuses, Wagons and the like. E. E. Kenworthy. 24,951. November 20th.

Tape Transmitter for Multiplex Telegraph Systems. O. Murray. 26,916. December 17th.